Decoding the productivity code

Towards an improvement theory for sustainable organizational performance

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Decoding the Productivity Code:
Towards an improvement theory for sustainable organizational performance

PhD Thesis
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Front page shows a cave painting from the Magura Cave in Belogradchik, Bulgaria.

Summary

This thesis introduces a new perspective on how organizations can achieve sustainable organizational performance in a changing world. By integrating Lean, the strength-based perspective, and organizational development, the false dichotomy and struggle between rationalization and employee well being, that is, the productivity code of the 21st century, is dissolved.

Today, organizations are pressured for operational efficiency, often in terms of productivity, due to increased global competition, demographical changes, and use of natural resources. Taylor's principles for rationalization founded organizational improvement one hundred years ago, but were later criticized by the human relations perspective that placed human needs in the center. Most organizations initiate isolated programs that focus either on economic rationalization or on employee development. However, a single-minded rationalization approach often ends up with demanding intense employee focus to sustain improvement and engagement. Likewise, a single-minded employee development approach often ends up demanding rationalization to achieve the desired financial results. These ineffective approaches make organizations react like pendulums that swing between rationalization and employee development. The productivity code is the lack of alternatives to this ineffective approach.

This thesis decodes the productivity code based on the results from a 3-year action research study at a medium-sized manufacturing facility. During the project period, the facility developed a continuous improvement capability by integration of rationalization and employee development.

The study shows that sustainable improvement capability requires strategic considerations about integration of improvement realization and development of improvement competence. These considerations can be formulated explicitly to an improvement strategy.

The study concludes that the researched facility developed continuous improvement capability over the time period and that it occurred through development of an organizational setting for improvement activities, termed the improvement system. The improvement system consists of five elements: The improvement process, participants, management, organization, and technology. The improvement system is not an organizational structure but rather a capability and readiness to organize the right improvement activities for a given challenge, i.e., to be prepared to initiate improvement.

The study shows how the effectiveness of the improvement system depends on the congruent fit between the five elements as well as the bridging coherence between the improvement system and the work system. The bridging coherence depends on how improvements are activated, information shared, and the approach to implementation.

Continuous improvement requires active leadership. The project shows how the improvement leadership approach determines if improvement activities exploit and optimize the existing system or explore new possibilities outside the existing assumptions. Improvement leaders can combine different improvement approaches, here problem solving and strength-based thinking, to achieve ambidextrous improvement capability that can balance exploitation and exploration.

An organizational transformation is necessary to develop continuous improvement capability. The project identified four levers for organizational transformation: Initiation with a purpose-driven affirmative approach, utilization of strategic metaphors, engagement of everyone through large-scale events, and focus on continuous leadership development to support the transformation process.

The project also showed that organizational transformation is not about changing people's thinking or training them in new methods, but rather about the development of a coherent improvement system and the competence to initiate and management improvement processes in an organizational setting. The study additionally showed that the organization accelerated the development of improvement capability by development of a second order improvement system that continuously improved the improvement system.

Dansk resume

Denne afhandling introducerer et nyt perspektiv på hvordan organisationer kan opnå bæredygtig organisatorisk performance i foranderlighed. Ved at integrere Lean, styrkebaseret ledelse og organisationsteori opløses dysten mellem rationalisering og medarbejdertilfredsstillelse, det 21. århundredes produktivitetsgåde.

I dag udfordres organisationer i stigende grad på deres produktivitet pga. øget konkurrence grundet globalisering og pga. demografi i forandring og udtømning af naturlige ressourcer. Taylors principper for rationalisering grundlagde organisatorisk forbedring for hundrede år siden, men er blevet udfordret af human ressource perspektivets menneskebehov i centrum. De fleste organisationer adresserer forandringsbehovet ved at igangsætte rationalisering eller medarbejderudvikling. Men, en ensporet rationaliseringstilgang ender oftest med at kræve målrettet medarbejderfokus for at fastholde engagementet. Ligeledes ender en ensporet medarbejderudviklingstilgang oftest med at kræve målrettet rationalisering for at skabe den ønskede produktivitetsgevinst. De ineffektive tilgange gør at organisationerne reagerer som et pendul, der skiftevis fokuserer på rationalisering og medarbejderudvikling. Manglen på alternativer til denne ineffektive forbedringstilgang har ledt til benævnelsen produktivitetsgåden.

Denne afhandling afkoder produktivitetsgåden baseret på resultaterne af et 3-årigt aktionsforskningsprojekt hos en mellemstor fabrik, der i projektperioden formåede at opbygge løbende forbedringskapabilitet ved at integrere rationalisering og medarbejderudvikling.

Studiet viser, at bæredygtig forbedringskapabilitet kræver strategiske overvejelser om at integrere realisering af forbedringer med opbygning af forbedringskompetencer. Disse overvejelser kan formuleres til en eksplicit forbedringsstrategi.

Studiet konkluderer at den studerede fabrik udviklede løbende forbedringskapabilitet i løbet af tidsperioden og at det skete gennem udvikling af en organisatorisk ramme for forbedringsaktiviteter, kaldet et forbedringssystem. Forbedringssystemet består af fem elementer: Forbedringsprocessen, deltagere, ledelse, organisering og teknologi. Forbedringssystemet er ikke en organisatorisk struktur, men en evne og parathed til at organisere de rigtige forbedringsaktiviteter til en given udfordring, dvs. en beredthed til at igangsætte forbedring.

Studiet viser hvordan effekten af forbedringssystemet afhænger af de fem elementers sammenhæng og koblingen mellem forbedringssystemet og det operationelle arbejdssystemet, hvilket afhænger af hvordan forbedringer aktiveres, information deles, og implementeringstilgangen.

Løbende forbedring kræver aktiv ledelse. Projektet viser hvordan ledelsestilgangen afgør om forbedringsaktiviteter udnytter og optimerer det eksisterende system eller udforsker nye muligheder uden for de eksisterende rammer. Forbedringsledere kan kombinere forskellige ledelsestilgange, her problemløsning og styrkebaseret tænkning, for at opnå ambidekstrøs forbedringsevne, der både udnytter og udforsker.

En organisatorisk transformation er nødvendig for at udvikle løbende forbedringskapabilitet. Projektet identificerede fire løftestænger for organisatorisk transformation: Igangsættelse med en formålsdreven affirmerende tilgang, anvendelse af strategiske metaforer, engagement af alle gennem stor-skala events og fokus på løbende ledelsesudvikling til at støtte transformationsprocessen.

Projektet viste også, at organisatorisk transformation ikke blot handler om at ændre folks tænkning eller at træne dem i nye metoder, men at det snarere handler om udviklingen af et sammenhængende forbedringssystem og kompetence i at igangsætte og lede forbedringsprocesser i en organisatorisk ramme. Studiet viste desuden at organisationen accelererede udviklingen af forbedringskapabilitet ved at skabe et andenordensforbedringssystem, der løbende forbedrede forbedringssystemet.

Preface and Acknowledgement

"All those days that came and left again... I never knew they were life itself."

This thesis concludes a research journey that started four years ago at the Technical University of Denmark, Department of Management Engineering. I want to dedicate this thesis to life and to living life as an adventure every day.

Over the past four years life presented me with a rollercoaster ride of high peaks and low valleys. I have experienced some of my largest crises over the time period, and the first started just before the project initiated. I fell on my bike and received a terrible concussion that made me lie in bed for three months without abilities to read, write, or reflect. Even though I was losing hope, I got support from my loved ones and managed to get back on track and recover.

One of the roller coaster peaks was October 2013 where Resonans celebrated their 10th anniversary with a learning expedition to New York City. It lifted my perspective to get inspired by management icons such as Jim Collins, Marcus Buckingham, Michael Porter, Jack Welsh, and Richard Branson with my colleagues at Resonans. We toured the city, discussed with architects at the Bjarke Ingels Group and the chief international economist of Deutsche Bank at the 56th floor of 60 Wall St. The peak was watching the Manhattan skyline from Williamsburg with my colleagues and one of them told me that I had to aim even higher to fully realize my potential. I stayed in the US for a month afterwards to write on my papers. I was fortunate to travel to the University of Michigan to meet Professor Jeffrey K. Liker and decided to return for 4 months the following year. I also got the opportunity to go to two Wolverine Football games at the Big House with 115.000 in attendance! The final game ended with a game winning field goal against the rivals from Michigan State, and then we all ran onto the field to celebrate! I also got the opportunity to visit my old home in Madison where I was an exchange student at the University of Wisconsin back in 2007.

When I returned to Denmark I met another life crisis. My wonderful girlfriend and I decided to split up, which was one of the toughest decisions of my life because she had been such an important part of my life for five years. But the roller coaster ride was not finished. Two days later, my father was diagnosed with aggressive cancer. I was hit hard and almost lost all my energy and optimism. Over the next months my father's health improved, so I decided I could go to Michigan. Thanks to a lot of support from new and old friends and family I slowly got energy back into my life and realized that I can bounce back from anything. I learned to live each day as if it is life itself.

Below is the physical development over the years from young PhD student in 2010 to experienced consultant and researcher in 2012 and after months indoors in the library in 2014.

In the end of my project I was elected chairman of the Danish Guide and Scout Association, which shows I am once again on an exciting roller coaster ride of life with energy to give whatever I can to the most amazing movement in the world.

I was recently asked a wonderful question: "How do you feel about the difference the strength-based perspective has made in your life?" My reply explained how it had made a profound positive impact on my life, and I started telling stories about it. Then he asked: "What about management engineering?" I paused, and could not really think of anything. He continued: "What could the potential could be for your life and others' if the same feelings and profound impact came from management engineering?" That opened up my mind, and I began my answer. I explained how the potential impact was even more profound. Imagine our lives if we had life value on top of our minds all the time, if we organized our lives to continuously improve and to waste as few moments as possible on non-value-added-time! That could change the world for the better. This realization has already changed my life, and hopefully it can add just a little inspiration to others.

To conclude the preface, I want to thank a series of wonderful people who have contributed to my journey. First, I want to thank my supervisor Niels Møller for embarking on the journey from the very first day, for your wonderful stories, excitement, inspiration, and support. Thank you for everything!

I also want to thank my co-supervisor Henrik Kongsbak for tremendous inspiration and co-creating time together at the office, in airplanes, in the car, at cafés, anytime we meet excitement happens. From the moment we met, I knew I wanted to create big things together with you!

To my colleagues at Resonans, all the wonderful Resonites I have spent time with the past years, I admire your rare gift for insistently wanting to create a better world every day by being useful. I will bear this mindset for the rest of my life.

To my colleagues at DTU Management Engineering, thank you for all the challenging discussions about research strategies, for the wonderful social times together.

I want to thank all the international scholars that have taken time to inspire me in my work. First of all, I want to thank Jeffrey K. Liker for hosting me for four months at the University of Michigan, for deep and inspiring conversations about the Toyota Way told through amazing reflective stories and analogies from the worlds of music, football, and every day life. Thank you for showing me the points through company visits and classroom simulations and thank you to your wonderful family for spending relaxed time with me. Second, I want to thank David Cooperrider, Kim Cameron, Jackie Stavros, Michel Avital, and Danielle Zandee for inspirational discussions.

My sincere regards also go to my fellow strength-based lean practitioner friends David Shaked, Daniel Richardsson, Johan Lilja, and Daniel Carnerud who have inspired my thinking profoundly.

Also, I send my warmest regards to all the engaged people at Novo Nordisk DMS who have contributed greatly to the project with their enthusiasm and active participation. Special thanks to Michael Møllmann for his visionary investment in the project, to Bo Holm Jensen for his absolutely unique and inspiring leadership, to Mette Astrid Lohse for insisting on the strength-based perspective even in a tough environment, to Henri Dolfi for his magnificent operational leadership, to Shahir Rona for the greatest discussions, and to the rest of the DMS people.

I would not have been able to finish this thesis if I had not joined forces with Frederik Agergaard, who has been one of my most important supports the past year. Thank you so much for spending early weekend mornings and late nights writing together with me and for challenging my thinking. Also thanks to my other supportive writing partners: Rie, Joseph, Signe, Eva, Frederik, Sanne, amongst others. And thanks to Kirsten and Andreas who have helped me with text, pictures, and references.

Thanks to my family and friends who have supported me the past years and insistently helped me to keep in contact with life outside research. In particular, thanks to my friends from scouting and Studenter-Sangforeningen.

Finally, I want to thank the two people who have been the most important supporters for embarking and finishing the journey. Camilla, thank you for having been the most important person in my adult life, for inspiring me to be the best I could be, and for supporting me in tough times and sharing memories for a lifetime. Rasmus, thank you for becoming a close friend and partner in crime, for hours and hours of discussing the research project at the facility, on hikes, at the office, on the phone, and at the library. You have been priceless for the outcome of this project!

After years of searching for answers to my research questions, finally, I have found Cinderella. At least, this project will be a princess to enlighten me for the rest of my life. I hope you will also find a tint of inspiration.

April 22nd 2014 – David Hansen

Content

1. Introduction

The most important innovation of the 20th century was management and organizations theory. This is a postulate, but I would argue that nothing else has contributed so profoundly to the advancement of society the past 100 years than our ability to coordinate and improve collective effort in organizations. Early contributors such as Frederick Winslow Taylor, Henry Ford, Henri Fayol, and Max Weber created theories and practices that helped turn the momentum from the industrial revolution into the age of progress: An age with a firm belief that society would inevitably improve and an age with increasing material wealth, knowledge, and human prosperity.

Management and organization theory and practice was refined further by significant contributors such as Peter Drucker on the role of leadership, W. Edwards Deming on quality management, Taichi Ohno and Shigeo Shingo on flow production and continuous improvement, Chris Argyris and Donald Schön on organizational learning, and scholars of organizational behavior such as Karl Weick and Edgar Schein, and the list could go on. The body of knowledge on management and organizations in the end of the 20th century was so profound that it seemed only as matter of time before we had cracked the code to optimal productivity in organizations and would be able to achieve limitless prosperity.

Enter the 21st century and the promise of optimal productivity does not any longer seem to hold. We have reached the limit for productivity based on the old theories. The world is changing rapidly, for example through the advancement in information technology, where the Internet and mobile communication has changed our lives and the nature of organizations tremendously. What used to be steady and laminar change in the 20th century is now turbulent and complex in the 21st century. Vast amounts of information is created and made available faster than it can be processed, we cannot rely on a few experts to create improvement; we need to get every mind into the game. We have left the age of progress and entered the age of complexity.

How do we manage and organize in the age of complexity? Shouldn't we just accept the new conditions and speed up the improvement pace? Some scholars and practitioners move away from structure, organization, and systems because they believe these factors inhibit creativity, development, and change. These scholars and practitioners yell "change, change, change" and have turned organizational development into a self-fulfilling prophecy where one change activity drives the need for more change. But, let us set aside this new change tyranny for a moment and ask a more fundamental question: What is really going on and what should we do about it? Maybe the solution is not more of the same, but to approach things differently.

In the early 20th century the first theories of organizational improvement were formed. They stated: Productivity is increased through scientific management by breaking down tasks, investigating them rationally, and describing how to execute them optimally. This sentence has been further refined over the century, but the logic is still the same. Improvement means better exploitation of resources through technical optimization. This is the logic of the industrial engineer.

In the middle of the century a human centered movement appeared that argued for improvement based on human well-being. The underlying theory was: Productivity is increased by giving people autonomy, fulfilling their psychological needs, and by removing harmful impacts at work, and then they will do their best. This is the logic of the human resource associate.

For decades these two theories have competed for attention at the work places. The two logics seem incompatible and the two types of specialists often do not understand each other. Consequently, most large companies have both types of specialists employed and take turns

emphasizing each, just as a pendulum. First, they engage the industrial engineers in optimization and experience a productivity increase, but after a while it drops again because of lacking people engagement. Then, they engage the human resource associates to empower employees and then productivity increases, but after a while the system gets inefficient and productivity drops again. Then again, the pendulum starts over with the industrial engineers and so on. The result of this pendulum approach is inadequate improvement efforts.

Even though there have been attempts of bridging the two approaches such as socio-technical systems design, organizations have not become capable of consistently improving productivity. The key to improving productivity has become a secret code that many people have chased to solve, e.g., Abernathy (1978) who described a productivity dilemma, but the attempts have so far been in vain. We simply have not solved the productivity code, and we do not have an effective theory of organizational improvement for the 21st century.

The front page shows a Stone Age cave painting of a human work system. Thousands of years ago we already had management and organization: Division of work and tasks, creation and use of tools, training of skills, and coordination of hunting. But more importantly, beside the warmth of the bonfire learning was shared and the human civilization slowly evolved. The Stone Age did not end because we ran out of stone, but because we learned to improve.

The question now is how we should improve organizations in the 21st century. I will argue that we should not just speed up the pendulum of technical and human logics. We need to solve the productivity code in the age of complexity. We need a new theory for organizational improvement.

This PhD thesis is the result of three years of decoding the productivity code and aims to add a piece of new knowledge to the topic of organizational improvement. The research project approached the quest by investigating two quite different approaches that had shown their potential for creating improvement of organizations. The first approach was the strength-based perspective that had appeared in the 1990s as a powerful organizational development methodology with an apparently amazing track record of organizational transformation, but no thorough empirical research. The second approach was Lean production and the Toyota Way that had shown capable of creating sustainable continuous improvement, but with limited success in transferring the concept to other organizations.

The research project investigated the productivity code through an empirical study of a company experimenting with the two management approaches. The study revealed new insights on how to decode the productivity code and lays the foundation for an improvement theory for sustainable organizational performance.

This introduction chapter will begin the thesis by first discussing why we need to decode the productivity code. Then, the formation of the research project will be presented followed by a reflection on the process of doing an industrial PhD project. The outline of the thesis will conclude the introduction.

1.1 Why We Need to Decode the Productivity Code

Why do we need to decode the productivity code of the 21st century? Let us take a look at the context of this question in order to fully understand the challenge. Although the research project is based out of Denmark, the challenges are general to the western world.

Productivity has gained increasing attention the past years. In western countries at least three drivers have placed productivity on top of the agendas of politicians and executives. First, our societies face demographical changes where a declining working population needs increased productivity to take care of the increasing number of elderly. Second, the increasing emphasis on environmental sustainability means we need to produce more with fewer resources. Third, increased globalization means increased competition that again demands more value for less cost. The third driver has the additional implication in Denmark that the manufacturing industry is under severe pressure and its potential outsourcing may cost research and development functions as well. Thus, productivity is a central theme in national economies and for private and public organizations for years to come. We need to solve the productivity code in order to create a thriving society.

However, the current productivity discussion in society is inadequate. In Denmark productivity has been a public discussion topic in the media for years, but the emphasis has either been on the political-economical conditions such as wages, taxes, and regulations or on individual factors such as education or narrow factors such as specific technological innovation. The discussion has omitted the organizational level of productivity and even neglected the central questions of what productivity is and what it should be used for. We need a new understanding of productivity.

Let me introduce a warning. Think for a moment about this: A century ago we used 70 % of our work efforts on necessities such as food, clothing and housing. Today, after getting efficient management and organizations, we use less than 10 % on necessities. This means that the rest of our productivity is free to be used for what we decide to prioritize in society. I will provocatively argue that in 2014, we have collectively and unknowingly decided, that we want to work, not just the remaining 90 %, but 110 % in order to get new iPads faster. We have decided to use the productivity increase for extra work and more consumption. Time magazine concluded that American families work 26 % more in the 2010s than in the1970s, but for less pay (Wolverson, 2011). Is this a more productive society? Probably, but is it more prosperous? No, I would argue that we have turned the biggest productivity progress in the history of mankind into less de facto value? Maybe it is not as bad as I make it sound, but I think the example should serve as a warning: productivity does not create value in itself, only if it is used effectively.

This thesis will focus on adding new knowledge to the understanding of productivity in organizations. However, the overall aim is to contribute to the development of a prosperous society. I will argue that we lose much value in society from a simplistic understanding of productivity.

When organizations sub-optimize or mindlessly improve without questioning the purpose of the efforts not only do we miss opportunities, we also often create undesirable outcomes. Productivity thus should not just be about efficiency but also effectiveness in order to create the necessary societal impact. I will highlight three challenges in society that I hope a new understanding of productivity can encourage to be addressed differently. Not by focusing the thesis on societal issues, but because more effective and reflective organizations will be better able to decide how they can contribute and have an ability to achieve the goal. Positive change in society requires a productive power, and this productive power can come from solving the productivity code.

As a short detour, I will highlight three societal challenges that I argue have been caused by a primitive approach to productivity, and that I hope will be addressed better in the future through many contributions such as this thesis's small contribution to understanding organizational improvement.

First, we are exploiting the natural resources of the Earth. Last century was the century of abundant energy and natural resources. Society gained access to amazing natural resources of oil and gas that has taken millions of years to form. We have limited amount of resources, but instead of using the amazing organic resource wisely such as for synthesizing high-value products like medicine and fine materials, we burn it as fast as we can. By focusing on short-term efficiency we not only risk harming the environment we also risk missing opportunities for doing something better with it. Thus, we need a new understanding of productivity that is holistic and encourage broader thinking about the common good over time. If we don't watch out, we will repeat the tragedy of the remote Easter Islands that once were a rich cultural society until they started mindless competition and rivaling tribes harvested as many trees as possible for their own use until they finally harvested the last tree and the islands lost the ability to grow any new ones. Society declined and after a generation they had recessed centuries back in development.

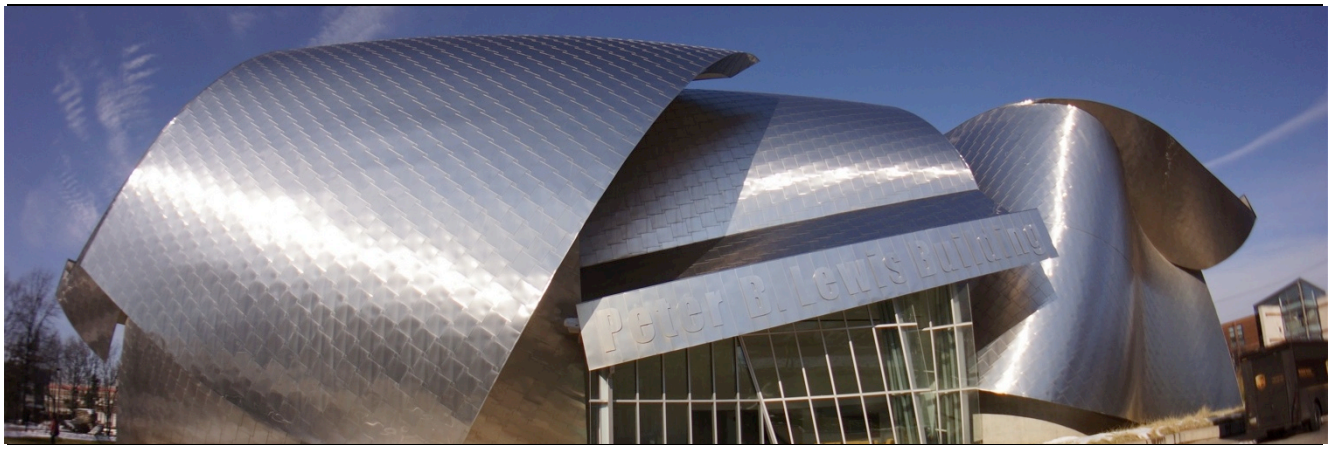
Second, I will highlight the challenge of healthy economy. We experienced an economic crisis in 2008 that has only showed its surface and will influence us for years to come. Yet, after a few years of crisis handling, politicians have returned to asking, how can we increase growth? How can we become more productive? It seems like no deeper reflection has been going on about the economic crisis and the assumptions that created it? The highly respected German Chancellor Angela Merkel even commented the following on the crisis in 2011: "We have identified the causes of the crisis and have supplied the steps for a solution" (Kernmayer, 2011). The following years, the European Union continued to follow the same track as before. Yet, we know we need to do something else with the upcoming demographical changes. This means that the new understanding of productivity should encourage the ability to challenge the existing assumptions and set new direction.

Third, I will highlight the challenge of life quality. Commercial organizations influence society through their products and services. In today's market, commercial companies are almost free to do what they want to attract customers. Most of them are short-term driven by their stock expectations and focus on cutting costs and raising sales to satisfy the next quarter's economical expectations. This means that the organizations exploit their resources to lure customers into following desire instead of what they really need. Take fast food and soft drink companies that appeal to the Stone Age bodies' survival instincts and make customers digest too much sugar and fat with health-threatening obesity as the consequence. Take technology companies that invent desirable products. We love our smartphones that give us remarkable access to the world's information! However, almost every day, I observe myself using it when I shouldn't. I have become addicted to the screen and I cannot go back because everybody else is also addicted. We are caught in the treadmill of consumption where we buy new stuff and then need to work more and then produce new stuff quicker and so on. This means that the new understanding of productivity should encourage a focus on real value creation instead of sub-optimizing by only focusing on creating efficient output.

Can these three challenges be overcome? I think so. Not by a new understanding of productivity alone, but this can be an element in the puzzle. If we pause and change the way we improve, we may become better at asking the right questions. Better productivity allows us to become better at creating the right value for the customer. As Adler (2006) puts it: "Now that we can do anything, what will we do?" We need organizations to ask these types of questions in their daily operations.

Our old theories of improvement do not solve the organizational and societal challenges today. We have reached the limit for how much value the principles of scientific management can add alone; instead we need new improvement approaches that are more capable of engaging people's full potential. Henry Ford once asked "Why is it every time I hire a pair of hands they come with a brain attached?" in frustration about the lack of discipline he required to achieve improvement. This challenge has now change, as clearly put by the former CEO of General Electric, Jack Welsh. When he retired he presented a clear challenge for management in the 21st century: "The biggest challenge now is to get every mind into the game!"

We need a new theory of improvement that matches this new challenge, and to create that we need new improvement approaches. This research project was initiated through a curiosity about whether the new improvement approach in the strength-based perspective could lead to a solution. First, let me introduce how I was exposed to the strength-based perspective for the first time and why it made me believe it could be a solution to decoding the productivity code.



1.2 Can the Strength-Based Perspective inspire Management Engineering?

The strength-based perspective is a promising new component for decoding the productivity code. This new perspective moves beyond the century old thinking of finding the one best way to organize and instead emphasizes how to engage people's strengths broader and deeper at work. The strength-based perspective has a potential of delivering this new component due to its focus on innovation and learning, people engagement, and elevation of resources. Some scholars even talk about a positive revolution that has not yet been fully understood but with huge potential, as indicated by the early paper "Bringing every mind into the game to realizing the positive revolution in strategy" (Barrett et al., 1995).

First, I want to share how I encountered the strength-based perspective. It started in 2008 during my volunteering at the national board of the Danish Guide and Scout Association and while I was carrying out my master studies in engineering. My mentors in the scouts introduced the strength-based perspective as an approach to leadership and organizational development. An approach that focuses on creating positive change by engaging people to discover their strengths and inquire into past success and use it to dream about a shared future. It is an approach of appreciating the best versions of the present and of striving for the best versions of the future by encouraging creative thinking, improvisation, and collaboration. Instead of looking for problems to solve, the strength-based perspective is looking for strengths to elevate and new opportunities to seize. A quite different perspective compared to how I was trained to think during my engineering training.

During a chemical product design class I experienced a decisive moment while my design team followed the steps of the technical development process. The textbook said we now needed to shoot down all the bad ideas with sound engineering arguments. While it might be a necessary step, the consequences here were undesirable. The team started to shoot down each other's ideas and protect their own, and this defensiveness almost turned the room into a warzone. In 30 minutes the collaborative spirit was changed into hostility until one girl was about to cry. We took a timeout and during the break I started wondering why the process did not encourage collaboration. I realized that the process only described the outcome steps of the project and did not help in terms of how to lead the process. I remembered some of the questions I just had been taught during my strength-based training at the scouts and decided I wanted to try a different type of questions. When we returned from the timeout I had prepared questions about the strengths of our ideas rather than the risks and about what we wanted to achieve instead of what we wanted to avoid. The result was astonishing. Not only did the atmosphere change suddenly, but we also managed to deliver a much better result. That was when I realized the potential of using a strength-based approach in engineering.

This realization encouraged me to do my master thesis on combining the strength-based perspective with engineering in 2009. The topic was the application of appreciative inquiry in chemical product development. I spent a semester doing the theoretical study at the Case Western Reserve University, the birthplace of appreciative inquiry, where the above photo of the business school building was taken. The building is designed by the architect Frank Gehry and management researchers at the university studied the design process to figure out how design thinking can be used in management, which led to the book Managing as Designing.

My master thesis concluded that the strength-based perspective had an undiscovered potential to inspire engineering practices. The thesis emphasized product design processes but also related to operations and business. Discussions during and after the thesis work concluded that many engineers were curious about the potential in the strength-based perspective and in particular its ability to engage people in new ways, in leadership, and to create organizational change.

In an interviews with a focus group about the potential in applying the strength-based perspective in engineering the participants highlighted potential gains such as enthusiasm, learning and a wider solution space as summarized shown in Table 1.

Table 1. Statements about the potential of using the strength-based perspective in engineering.

Category	Potential of the strength-based perspective in engineering
Engage strengths better at the work place	• Engage people's strengths to bring more competencies into the work place • More life and energy • Better match between competencies and goals
Create more mental energy & resources	• Get people more engaged • Improve trust and cooperation (social capital) • By creating a space for playfulness • Turns short term result focus into long term result focus • Fun to do what you are good at • By more appreciation of what works well
More learning	• Learn from positive deviations & success • People improve more when they have fun • Better understanding by systematic learning of what already works • Enables learning instead of blame and defensiveness
Better solution process to create improvements	• More creativity and a larger solution space • Synergy between people in the problem solving • More people get engaged in the process • More proactive solutions • Enables a focus on attractive quality not just 'need to have'
Engage in the goal, not the task	• Structure for more empowerment • By visionary leadership • Meaningful goals create more engagement • Makes people bring their ideas and solutions • People stretch more when they want to reach goals
Drives the desired culture	• Use different questions to drive culture and a new focus • Drive a more engaged and cooperative culture

These promising features and a personal curiosity for the approach made my want to investigate the potential in the strength-based perspective further. I decided I wanted to bring it into the world of engineering management. Luckily, I was soon presented with the opportunity.

Project Partners

resonans

novo nordisk®

DTU

1.3 Crafting the Research Project

After I finished my master thesis at the Technical University of Denmark my supervisor Niels Møller suggested that I continued my curiosity for the strength-based perspective as a researcher and followed up my master thesis findings. The idea was intriguing, but I had gotten the idea that I wanted to practice appreciative inquiry as a consultant, and had started figuring out which consultancies had this specific expertise. Niels presented the idea of an industrial PhD, which meant a research project co-funded by and co-created with a company. I liked the idea as it was a way of bridging the two ideas of doing research and practicing the new field as a consultant. Then I contacted the top four consultancies for the strength-based paradigm and asked to set up a meeting about an industrial PhD. Three of them replied quickly with interest, and the first one got my attention.

I met up with a partner from the consulting group Resonans, a 12-person consultancy specialized in strength-based organizational development and leadership training. The partner, Henrik Kongsbak, and I immediately connected well and got engaged in theoretical discussions about the potential of the strength-based perspective based on my master thesis. During the discussion an old idea came to Henrik's mind. A few years earlier he had carried out a very successful project together with a manufacturing facility that worked with Lean production. They had succeeded in creating a transformation when the facility was about to close. Through a strength-based employee mobilization approach they had turned around the situation and showed so much potential for employee-driven improvements that the facility was chosen for ramp-up manufacturing of new product. In the end of the successful transformation project the corporate vice president of the manufacturing facility and Henrik had discussed why there had not been any studies about how Lean production and the strength-based perspective could be used together to create employee-driven improvements. They had shown that it was possible to use together for a change project, but the knowledge about how to use the two approaches in the daily operations was limited.

When Henrik presented this idea I quickly realized that this question was an outstanding opportunity for combining my interest for practicing the strength-based perspective in an engineering context with research. We therefore set up a meeting with the corporate vice president, Michael Møllman. The idea quickly gained interest from all sides and we decided to go for an industrial PhD project with three collaborating partners: The Technical University of Denmark, Resonans A/S, and Novo Nordisk A/S - Device Manufacturing and Sourcing.

The purpose of the research project was to investigate whether the strength-based perspective and Lean production could be combined to more effectively engage employees in improvements. That is, the project was scoped as a continuous improvement project. The research approach was action research that would allow me with wide access to the Novo Nordisk Device Manufacturing

and Sourcing (DMS) factory and opportunities for influencing their development in order to make the research more engaging.

The collaboration between the three parts was quite exceptional as they represented three different perspectives on valuable knowledge: The University's academic knowledge, the consultancy's emphasis on useful and communicable knowledge, and the factory with focus on practical and effective knowledge. Because the project had these three collaboration partners and a quite remarkable research freedom, it led to a very exciting journey, as described in the next section.

1.4 The Journey of an Industrial PhD Project

In this section I will highlight some of the attributes of conducting an Industrial PhD project with three collaboration partners. The construction of the Industrial PhD project emphasizes the integration of different types of knowledge. Gibbons (1994) introduces two knowledge creation modes, mode one and mode two. Mode one is the academic ideal of producing knowledge through a rigid methodological approach that is validated and further qualified by peer review. Mode two is the practitioner ideal of producing knowledge in its context for a particular purpose. Mode one knowledge's primary quality criterion is validity, while the primary quality criterion of mode two knowledge is usefulness.

The traditional academic view on its mode one knowledge production was that it was the best way to produce sound knowledge that could later be disseminated to practitioners. However, this approach has been challenged the past decades by practitioners who demand more useful knowledge from the universities and by practitioners who create their own knowledge within their own context. On the other hand, the practitioner driven knowledge production has been criticized for spreading ineffective and not validated knowledge that leads to management fads. Abrahamsen (1996) describes how the increasing number of new management approaches the last decades have led to a demand and supply of management fashion with little critical thinking in terms of their value. There has become a growing divide between academic research and practitioners' knowledge in the field of management. Industrial PhD projects aim to bridge this gap by designing research projects that engage practitioners and academics to collaborate and by deploying a young researcher in both camps.

The aim of engaging in the both the academic and the practitioner worlds were the exciting conditions for this PhD project. This means that the goals for the project not only were to produce academic knowledge in scientific papers and in this thesis, but also to provide practitioners with practicable knowledge along the way.

I have been very fortunate to be part of three very different environments the past years where I have learned very different things. The interaction between the different languages spoken in the academic world, among consultants, and in the industry has been a key to the progress of this project. The different contributions to the progress of the project are presented in the following.

First of all, participation in the academic world has given me priceless insights into understanding research and theory. The years of being a PhD candidate have been tremendously developing due to the many learning opportunities built into the study program. I have taken courses at six different universities and in that process met many inspiring PhD students. Participation in academic conferences has been some of the most inspiring experiences, as they created reflective spaces to process new ideas from the world's leading scholars and were a

platform for getting academic feedback on my findings. Also, the many work sessions in the research group at the Technical University of Denmark has provided me with substantial learning about academic life and new theories. Being part of such a diverse research environment has opened my eyes to the abundant amount of theoretical perspectives on engineering management.

Furthermore, my research visit at the University of Michigan provided tremendous insights into the academic world. The discussion sessions and company visits I had with Professor Jeffrey K. Liker gave me new perspectives on my research questions and opened my eyes even more to the theories behind the practices of the Toyota Way. Experiencing this world-class research institution also opened my eyes for how the academic world is interconnected, and may be the world's largest collaborative network. Being part of the weekly discussion seminars at the Interdisciplinary Committee on Organizational Studies and events at the Center for Positive Organizational Scholarship also inspired my thinking through illuminating how world class scholars from diverse fields inspire organization studies. Also, the collaboration with the quality management research group at the Mid Sweden University in Östersund provided valuable and inspiring academic discussions, and in particular the about the rare combination of the strength-based perspective and operations management.

Being a part of Resonans has been such a rewarding experience. It is quite exceptional to be part of an organization that so clearly and genuinely wants to contribute to a better world and that prioritizes its efforts to collectively make an impact, such as by sponsoring this research project. The time with highly skilled business consultants taught me to understand useful knowledge. I got a new view on how to translate theory into useful knowledge and how to present it to others in order to make it useful for them. Resonans has also had a development journey during my time period where the firm clarified its belief in creating useful organizational impact – not just selling projects. This change was actually harder than imagined as most clients just wanted to buy a service even though they clearly needed something else more. My being a part of the company contributed to this development by providing new perspectives on their services. My engineering perspective complemented the psychological perspective in terms of not only changing people's thinking but also their organizations.

The participation in Resonans also provided opportunities for practicing and consolidating my findings along the research project. I engaged in a number of consultancy projects that were really helpful in translating my abstract findings into useful knowledge for practitioners.

The participation at Novo Nordisk Device Manufacturing and Sourcing has made me understand the language and logics of practice. The logics at a manufacturing facility are so different from at an academic institution, and I am grateful for the playful tone they used to help me translate abstract theories to practice-oriented knowledge. The access to talk to all the different work groups with different types of education also helped greatly in terms of understanding different perspectives in the world of practice.

The different stakeholders and their different demands have been very rewarding in giving input to the project. The demands have also been challenging to balance in terms of prioritizing where to focus efforts. My desire to contribute to all the stakeholders meant that I chose to engage in a broad range of activities rather than to focus on a few deep projects. My dissemination activities have therefore also been broad with a lot of practitioner presentations, a few practice-oriented publications, and a few academic conference presentation and papers. An extensive list of dissemination activities is attached in the appendix.

I will summarize my experience of the Industrial PhD program as a very engaging approach to bridging mode one and mode two knowledge productions. The journey has contributed tremendously to my ability to talk different languages, to see different perspectives, and given me a desire to contribute to bridging academics and practice for the rest of my life.

1.5 Outline of the Thesis

This thesis is the academic dissemination of the industrial PhD project, i.e., its role is to present the project's to satisfy the academic requirements. However, since the project emphasized practicable knowledge, the thesis has been written to make it accessible for practitioners as well.

The thesis is paper-based, which means that its primary content is its three self-contained papers. An overview of additional dissemination activities can be found in the appendix.

Following the introduction, the thesis introduces the theoretical foundation of project, clarifying the desired outcome of improving productivity and summarizing existing theoretical perspectives on continuous improvement. Third, the theory chapter presents the two improvement approaches Lean continuous improvement and the strength-based perspective and the unit of analysis.

Then follows the research design chapter that begins with the research questions. The case company is presented along with its context. Then, the methodological approach is discussed along with a series of challenges for researching this topic.

The fourth chapter will present the findings of the research project in three papers. The title of the first paper is "What is your improvement strategy?" The paper presents a discussion of the different strategic approaches to improvement a company can use and suggests different improvement methods to match particular improvement strategies. The second paper is titled "Conceptualizing Dynamic Capabilities in Lean Production: What are they and how do they develop?" This paper presents a longitudinal study of a case company that develops dynamic capabilities. The paper builds a conceptual model for understanding dynamic capabilities as an improvement system and how to organize its effectiveness. The third paper "Ambidextrous Continuous Improvement: A case study of Strength-based Lean Leadership" presents an approach for achieving contextual ambidexterity, i.e., the ability to concurrent exploration and exploitation. This paper also offers an explanatory model for how the improvement trajectory shifts happen and the mechanisms that inhibit or facilitate the shift.

The fifth chapter discusses the findings for all three papers in relation to the research questions as well as their implications for practitioners. First, an overview of the strategic considerations for achieving sustainable continuous improvement is discussed. Second, the improvement system framework is discussed in relation to its applicability for creating sustainable improvement capability. Third, the operational role of improvement leadership is discussed with emphasis on the improvement approaches and fourth, organizational transformation is discussed.

The thesis is concluded with a reflection on how its findings decode the productivity code and contributes to new improvement theory for sustainable organizational performance.

As appendix, a list of dissemination activities is included with practitioner-aimed papers.

2. Theory

Continuous improvement has been a central discipline in operations management since its beginning (Taylor, 1911; Deming, 1982). The scientific management approach introduced a theory of improvement that was based on division between labor and rationalization specialists and a view on implementation as formalization in the organization. The human relations movement that followed in the middle of the 20th century challenged this view by arguing that improvement should instead happen based on satisfying individuals' psychological needs. Their improvement theory was that the removal of the coercive elements of work would empower individuals to perform better. From the 1980s continuous improvement has successfully been introduced throughout the world in several waves. The most successful wave has been the Lean movement that is now used throughout manufacturing, service, administration, product development, and in the public sector (Voss, 2005; Arlbjørn and Freytag, 2013). The Lean movement has shown itself as a very promising practice for addressing the productivity code.

However, despite the extensive diffusion of continuous improvement practices, and particularly Lean, there has been little discussion about the underlying theory of improvement. Also, the definitions of Lean and other continuous improvement practices are ambiguous, which make them difficult to research (Brännmark et. al., 2012). For the case of Lean, the literature shows a divide between 1) Lean as a collection of tools for concrete problem solving and waste reduction (Hines et al., 2004; Pettersen, 2009), 2) Lean as a set of actionable principles (Womack and Jones, 2003), and 3) Lean as a philosophy of long-term excellence based on learning, focus on customer value, and waste reduction (Liker, 2004; Shah and Ward, 2007). This divide has not made it easier to discuss the underlying theory of improvement even though there seem to be consensus about the challenge of creating sustainable competitive advantage through effective continuous improvement (Kaye and Anderson, 1999; Savolainen, 1999; Lewis, 2000; Delbridge and Barton, 2002; Liker, 2004; Bateman, 2005).

The field of continuous improvement is full of mature and effective methods and techniques. However, a review of the literature on continuous improvement quickly reveals that academics and practitioners rely on many theoretical fields to explain and discuss the effectiveness of the continuous improvement practices. Yet, there is no consensus on a shared theoretical underpinning, which makes it almost impossible for managers to make informed decisions about what approach to take to productivity improvement, e.g., what practices to use and how to support them in the organization. Thus, there is a need for a theoretical clarification before new approaches, such as the strength-based perspective, can be integrated into an overall model.

This thesis aims to decode the productivity code to enable managers to make better decisions about how to practice continuous improvement and create organizational capability for productivity improvement over time. The purpose of this chapter is to clarify the existing theoretical standpoints that can be used for understanding the productivity code and to define a unit of analysis for the research project.

The chapter will first present the challenge of the productivity code, then highlight theoretical perspectives and the existing knowledge base as well as the two improvement approaches Lean continuous improvement and strength-based improvement.

2.1 The Productivity Code

The productivity code that was clarified in the introduction chapter comprises two questions. First, what is the organizational capability for sustainable continuous improvement? That is, how should improvement be organized and managed to be able to effectively create sustainable continuous improvement. Second, how do we create the organizational transformation necessary to lead to this organizational capability? That is, how we move today's organizations into the desired future state of sustainable continuous improvement including the necessary culture shift.

The first question involves the bridging of several apparent paradoxes such as whether to focus on technical or social improvement that led to the described pendulum effect in the introduction chapter. Since the introduction of operations management we have recognized how organizational efficiency can be improved through systematic process analysis and improvement (Deming, 1982; Delbridge and Barton, 2002). Yet, continuous improvement has been criticized for only being efficient in the short run while leading to stagnation or even decline in the long run, since the capabilities that create efficient execution hinder learning and flexibility (Benner and Tushman, 2003). Thus, the exploitative capability for short-term efficiency needs a complementary mode leading to long-term success. The two can seem incompatible and be challenging to manage together, which Abernathy (1978) termed the productivity dilemma. The dilemma is still an ongoing discussion (Adler et al., 2009) since organizations in a dynamic environment not only need to exploit their current resources and capabilities; they also need to be able to explore new opportunities to achieve long-term success. This core capability for both short and long-term improvement is called ambidexterity and has been studied for decades, but ambidexterity is challenging due to the inherent incompatibility between exploitation and exploration (March, 1991).

The second question involves organizational transformation. Arlbjørn and Freytag (2013) show that there are no consistent results based on Lean implementation. They concluded from an extensive literature review that less than 15 % of the studies documented positive outcomes from a Lean implementation. This shows that Lean implementation is still a central problem and that there is a need for understanding the cultural transformation necessary to achieve continuous improvement capability (Edwards et al., 2010; Liker and Morgan, 2011). Even though the change management field has been studied for decades, the question of how to transform organizations into learning organizations with sustainable improvement practices and culture has not yet been solved.

The next section will present an overview of existing theories on improvement that will serve as underlying basis for the thesis.

2.2 Theoretical Perspectives on Continuous Improvement

The two questions for decoding the productivity code have been addressed through different theoretical perspectives. Each perspective emphasizes different elements that are important to get an understanding of continuous improvement and they use different units of analysis. This means that the theoretical perspectives are not easily compared and are difficult to use for discussing and deciding which practices to use. Thus, emphasis will be on understanding their units of analysis. This section presents and discusses five theoretical perspectives in order to clarify the existing knowledge in the field and what knowledge gap that needs to be addressed to decode the productivity code.

Dynamic Capabilities: Strategic Improvement and Meta-routine Learning

The first theoretical perspective is dynamic capabilities, which comes from the strategy literature. The resource-based view on strategy concludes that organizations with superior capabilities, such as valuable, rare, inimitable, and non-substitutable resources, can achieve sustainable competitive advantage based on lower costs or superior product quality (Barney, 1991; Teece et al. 1997). Winter (2003) defines a capability as "a high-level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type." Thus, capabilities translate to the organizational ability to operate efficiently.

It is necessary to change or develop new capabilities in order to achieve or sustain competitive advantage in an ever-changing environment. This can be done either through ad hoc problem solving or by continuously and systematically developing capabilities, which is termed dynamic capabilities (Winter, 2003). Teece et al. (1997) define this ability to cope with change as dynamic capabilities, and explain them as: "a firm's ability to integrate, build, and reconfigure internal and external competences."

Research has been concerned with understanding dynamic capabilities for years (Teece et al. 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Winter, 2003; Katkalo et al., 2010). The research with the dynamic capabilities view has explained how companies that possess dynamic capabilities achieve long-term competitive advantage. However, the understanding of what dynamic capabilities are at the operational level is an ongoing discussion (Katkalo et al., 2010). One view is that dynamic capabilities are specific and identifiable processes (Eisenhardt and Martin, 2000) and another view divides them into two types: operational improvements and strategically and long-termed (Zollo and Winter, 2002). A deeper understanding of what dynamic capabilities are and how they develop can be the key to achieving long-term success.

Zollo and Winter (2002) offer a definition of dynamic capabilities that can help with a further understanding of their nature: "a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness." This dynamic capabilities definition comprises two main components: a stable pattern and collective activity. The definition connects dynamic capabilities to the concept of continuous improvement since collective activity can be seen as a problem solving activity in continuous improvement and a learned and stable pattern can be seen as the context for the problem solving activities. Bessant and Francis (1999) also argue that continuous improvement capabilities are a form of dynamic capabilities and offer insights into the qualitative criteria that determine continuous improvement maturity. Anand et al. (2009) further reinforce the relation between dynamic capabilities and continuous improvement by studying how continuous improvement infrastructure, can act as an organizational context for dynamic capabilities. These perspectives highlight how organizational structure may have an important role in supporting continuous improvement capabilities.

The theoretical perspective of dynamic capabilities thus argues that organizations can achieve improvement capabilities through meta-routines that systematically modify the operating routines in organizations.

The unit of analysis in this theory is two types of routines: Operating routines in organizations and meta-routines that modify the operating routines.

Organizational Learning: The Role of Governing Variables

Argyris and Schön (1978) proposed a theoretical perspective on organizational improvement that describes how organizational learning comes from detection and correction of errors through either

single loop learning or double loop learning, as shown in Figure 1. This theoretical perspective differentiates organizational learning between the type that only adjusts actions from the type that involves questioning and change of the governing variables that guide organizational actions. The organization's ability to learn thus implies a reflexive ability to carry out double loop learning.

The unit of analysis for this perspective is governing variables and the problems that activate learning.

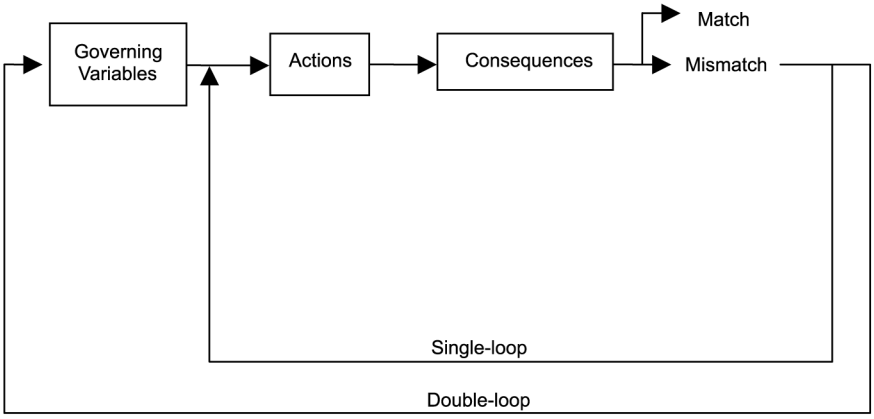


Figure 1. Single and double loop learning (Argyris, 1999).

A related perspective on organizational learning is the problem-finding and problem-solving approach (Nickerson et al., 2012). This approach argues that organizational learning happens through three interrelated activities: First, problem finding, framing, and formulation, second, organization of knowledge sets to create valuable solutions, third, efficient implementation of solutions for value creation and capture.

The unit of analysis for this perspective is the problem, which encompasses the three mentioned activities.

Individual Learning and Improvement

The role of individual learning has also been a central theoretical perspective for understanding continuous improvement. Nonaka (2007) argues for the importance of the individual in creating new knowledge and transforming it to organizational knowledge. His notion of tacit knowledge emphasizes the role of building up uncodifiable knowledge through learning-by-doing. The theoretical perspective also describes the importance of translating tacit knowledge into explicit knowledge and transferring the knowledge types to others in order to accumulate organizational learning.

Rock and Schwarz (2006) add another theoretical perspective to individual learning based on neuroscience. They describe how habits get wired in the brain's basal ganglia that activates routines with little brain effort, whereas any activity that challenges routines happens in the prefrontal cortex and requires much more effort and feels uncomfortable. Rewiring of habits and subsequent learning is inhibited when people are told what to do. Instead, brain rewiring is facilitated by practices of coaching where the individual finds their own solutions to problems. They conclude that change of individual behavior requires focused attention over an extended period of time. New habits require support to overcome the energy-related resistance in the brain and repetition to create new neurological wires.

The individual learning perspective also emphasizes the role of different learning styles and thinking preferences. For example, three approaches are the learning style inventory (Kolb, 1981),

the whole brain model of thinking preferences (Herrmann-Nehdi, 2010), and the strengths finder inventory (Rath, 2007).

The units of analysis of the individual learning perspectives are individual knowledge, habits, and processes.

Social Capital: Improvement through Relational Coordination

Another theoretical perspective on improvement is the organizational social capital (Adler and Kwon, 2002; Hasle and Møller, 2007). This perspective emphasizes the organizational capability to collaborate across functions for achieving its core tasks. A Danish research strand has demonstrated the importance of justice, trust, and collaborative capability for achieving social capital and improving organizational performance (Olesen et al., 2008).

A similar U.S. research strand uses the term relational coordination (Gittell, 2000). This research has demonstrated how quality and productivity correlates with different work groups' capability for timely, frequent, and accurate communication with each other as well as mutual respect, shared goals, and shared knowledge.

This perspective's unit of analysis is intergroup relations and management.

Models Integrating Multiple Theoretical Perspectives

As the presented perspectives show, many theoretical perspectives are used to discuss continuous improvement and they address quite different, yet relevant issues. A literature review showed that only few studies discuss these different perspectives on improvement together (even though this was called for more than a decade ago; Lange-Ros and Boer, 2001). Despite the many different theoretical perspectives on continuous improvement, there are still no discussions about a coherent theory. Choi (1995) discusses how continuous improvement and change management can coexist, but does not discuss them as parts of a more coherent improvement theory. Boer and Gertsen (2003) reviewed innovation theory, organizational learning theory and continuous improvement theory in order to contribute with practicable knowledge on how to approach the challenge of combining operational effectiveness and strategic flexibility. Their conclusion was that organizational learning theory is too conceptual for immediate use and continuous improvement theories are normative but scarcely validated or conceptually discussed.

The closest to an improvement theory that incorporates several perspectives are models presented by Zollo and Winter (2002) and Murray (2002). Zollo and Winter (2002) present an integrated model where they illustrate the activities in knowledge evolution, as shown in Figure 2. This model combines the dynamic capabilities and the organizational learning perspectives and gives an explanation for how dynamic capabilities can be developed through learning mechanisms. However, the model does not describe individual and relational roles or relate to the design of the work.

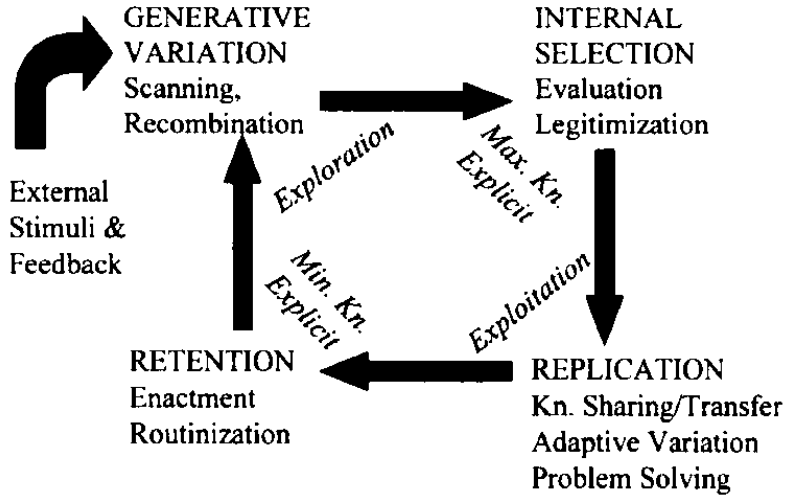


Figure 2. Activities in the Knowledge Evolution Cycle (Zollo and Winter, 2002).

Murray (2002) presents a model that combines several of theoretical perspectives. He clarifies the relationship between an organization's interactions with its environment as illustrated in Figure 3.

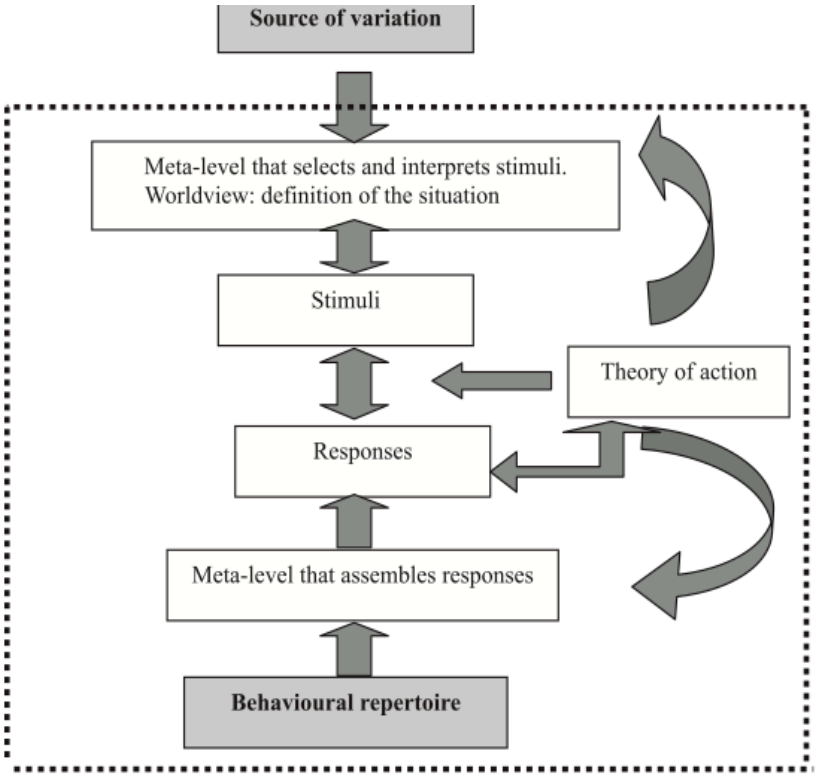


Figure 3. An Organization's interaction with its Environment (Murray, 2002).

He builds on these elements to develop a model that he terms unbounded learning that integrates the individual learning perspective, organizational learning (adaptive and generative learning), dynamic capabilities as well as culture, as illustrated on Figure 4. This model highlights different aspects to consider for understanding organizational change, but it does not yield a coherent improvement

theory that can contribute to decoding the productivity code, as it only describes learning processes and does not inform how to design or implement better improvement in organizations.

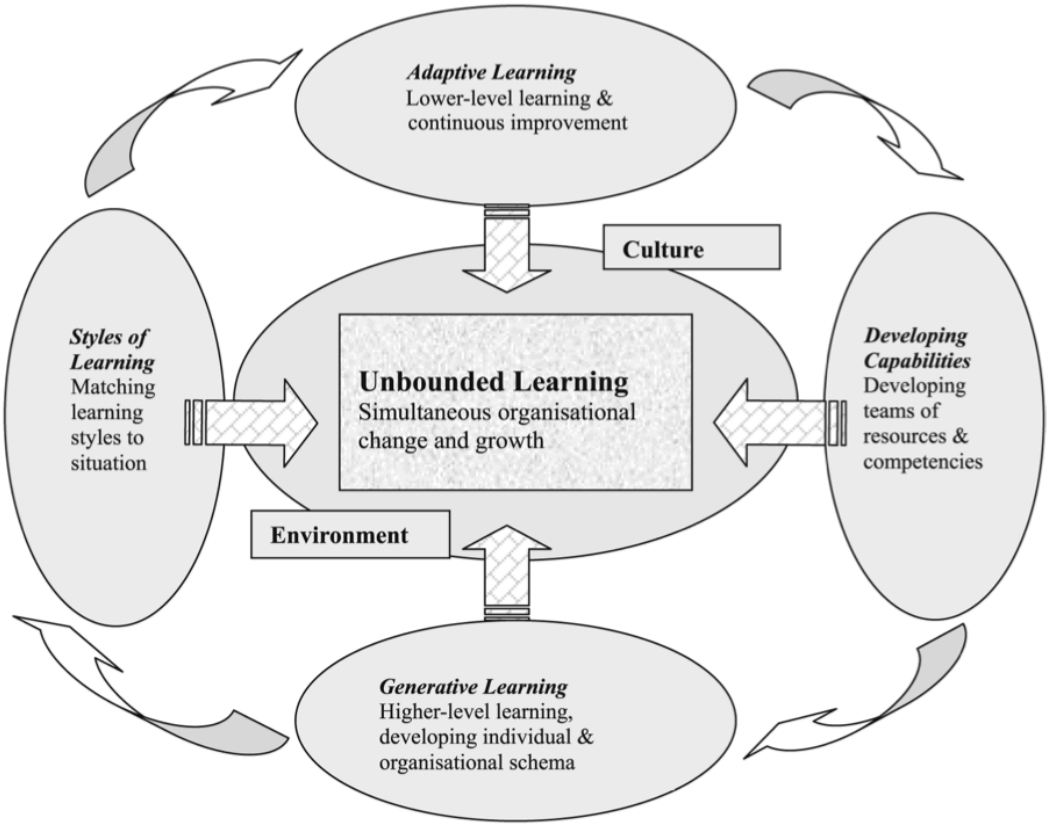


Figure 4. A combined model for describing improvement (Murray, 2002).

This section revealed that there is still no coherent improvement theory for continuous improvement that can be used as basis for an informed discussion about different practices. The perspectives are primarily concerned with individual and organizational learning processes, such as tacit and explicit knowledge and such as single and double loop learning. However, there is only limited focus on the organizational processes and structure of continuous improvement. This finding generates curiosity for further investigation into the structural aspects. Additionally, the review of the theoretical perspectives highlights that the units of analysis are very different. This shows a need for explicitly addressing the unit of analysis, which will be done later in this chapter.

Organizational Transformation

Some organizations need a thorough transformation in order to achieve continuous improvement capability, which requires profound change, for example changes of the organizational culture (Liker and Hoseus, 2007; Liker and Morgan, 2011).

Boer and Gertsen (2003) discuss whether organizational transformation should be addressed as a one-off transformation or be managed as a continuous improvement project with iterations of improvement. This difference is also discussed by Weick and Quinn (1999). They discuss the difference between theories of episodic change and continuous change. Where the episodic change has the logic unfreeze-transition-refreeze that supports one-off change interventions, the continuous change requires another logic. They propose the logic freeze-rebalance-unfreeze as an intervention theory for continuous change.

Continuous improvement capability has been attempted implemented in various ways, but there is no consensus on effective models for organizational transformation. Suggestions for implementation approaches include one or more of the following elements: Model line, tool rollout, audits, deployment of coaches, kaizen events series, improvement portfolio, management training, etc.

The strength-based perspective offers new approaches to organizational transformation that has not been applied for creating continuous improvement capability. For example, the appreciative inquiry summit (Ludema et al. 2004), and change interventions based on generative methods such as guiding metaphors and improvisational action (Bushe and Kazzam, 2005). These generative change methods emphasize co-construction of new meaning through broad involvement. In the following section, the two improvement approaches Lean and the strength-based perspective will be presented.

2.3 Lean and the Strength-based Perspective

This research proposes that we can add to our understanding of how to create the conditions of continuous improvement leading to dynamic capabilities by combining two perspectives and their associated methods: Lean and the strength-based perspective. These two improvement approaches will be introduced briefly in the following as well as a review of how they have been used together. This section provides the theoretical underpinnings for the research design.

Continuous Improvement in Lean

Lean production, introduced in the 1980s has spread widely in private and public organizations, for production and for service, and in all types of industries. Even though there has been an extensive focus on Lean production in research and in practice (Arlbjørn and Freytag, 2013), there does not seem to be a consensus regarding the definition of Lean as a concept (Brännmark *et. al.,* 2012). One way to describe the different perceptions of Lean is presented by Arlbjørn *et al.* (2011) who divide them into the three layers:

- Lean philosophy: Respect for people and continuous improvement (Liker, 2004)
- Lean principles: 1) Define value for the customer, 2) Map the value stream, 3) Create flow in the value-creation, 4) Use pull from the customer, and 5) Seek perfection with continuous improvements (Womack and Jones, 2003)
- Lean tools and techniques: *e.g.* Value Stream Mapping, 5S, cause and effect analysis, etc. (in line with the Toolbox Lean definitions by Hines *et al.,* 2004, and Petterson, 2009).

At the philosophical layer Lean has been described as a total organizational philosophy aimed at developing excellence in people, processes, and technology to achieve long-term sustainable success, i.e., respect for people and continuous improvement (Liker, 2004). Others describe the Lean philosophy as an aim of reducing waste and improving customer value (Shah and Ward, 2007). The principles perception describes Lean as a series of principles to adhere to. The tools and techniques perception offers a large amount of different methods that can lead to improved performance. Most of which have been solutions to specific problems at Toyota and that other companies adopt as-is. One example is the value stream mapping technique (Rother and Shook, 2003) that has an embedded goal of removing waste by mapping current state value streams, identifying waste, mapping future state value streams, and then striving to achieve the future state.

These references show an extensive variety of different Lean perceptions. In practice, most are based on the assumption that in order to improve customer value it is necessary to remove waste by

thorough root cause analysis, as described in an extensive review by Petterson (2009). Another example is from a longitudinal case study of Lean in knowledge work (Staats and Upton, 2011). After identifying a potential for improvements due to an unproductive value stream, the authors stated that the remedy for improvement was to ask focused why-questions: "*Instead of assuming that the approach used for a process is right, assume that it's wrong. […] Why am I attending this meeting? Why am I filling out this report? Why am I standing at the printer?*" (Staats and Upton, 2011).

Even though this Lean understanding is not in line with more recent clarifications by Liker and Convis (2011) or Rother (2010), much practice is still underpinned by a problem-driven approach to Lean rather than an excellence-driven approach. The implications of Lean as a problem-driven approach will be further investigated in the following.

In everyday language problem solving is used for any improvement approach but in the following Lean problem solving will be used as a technical term for the improvement approach based on root cause analysis (Hill, 2012; Liker, 2004). Root cause analysis is widely used in operations management for creating continuous improvements (Delbridge and Barton, 2002) with methods such as Pareto diagrams for identification of problems (Kumar and Suresh, 2006) and Ishikawa diagrams for cause localization (Hill, 2012).

Liker (2004) and Shook (2008) provide a thorough description of Lean problem solving that is often called A3 systematic problem solving. The process can be simplified into three steps: Understand the concern, investigate the root cause, and implement the countermeasure, also widely known as the three Cs (Delbridge and Barton, 2002). The guiding metaphor for the process is a funnel where the focus is gradually narrowed until the 'correct' point of cause is found, and then investigated with why-questions until the real root cause is identified and solved by creating a countermeasure and subsequent standardization. Solving the root cause implies that it is not just the initial problem at the surface that is addressed but the deeper underlying problem.

Figure 5 shows a simplified schematic representation of this root cause based problem solving approach (produced by the authors for illustration). The first step is illustrated at the top right as the problem statement, the second step is the root cause analysis, and the third step illustrated at the lower line is the countermeasure step.

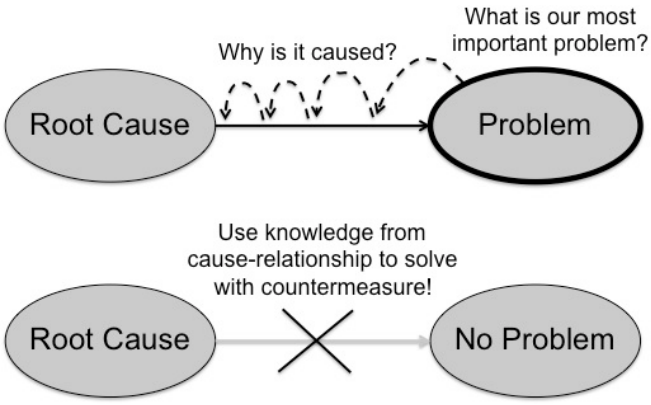


Figure 5: A schematic illustration of the Lean problem solving improvement process.

Lean literature stress that an iterative and experimentation approach is necessary to create good results.

This presented understanding of the Lean problem solving process only describes the direct impact of solving the problem, but during the activity it will also create indirect outcomes such as individual learning about the technical systems. The Lean literature describes how problem solving activities can be organized to improve learning of problem solving skills and Lean thinking ways through coaching, team activities, and broad consensus seeking in the organization (Liker, 2004; Shook, 2008; Rother, 2010). Rother (2010) argues that the underpinnings of continuous improvement rather than root cause analysis should be the scientific method and iterative learning, which is simple to understand, but very challenging for people to adopt as a way of thinking. He argues that it requires a fundamental change in mindset, which must be learned (as noted by Rock and Schwarz, 2006) by deliberate practice with a coach over extended time periods. When a critical mass of leaders develop the mindset it becomes the way to approach achieving any goal from organization-wide strategies to local improvements.

Critical investigation of the problem solving process shows that it may have limitations that have not been raised in the operations management literature. In organizations theory literature problem solving is criticized for not being optimal for creating double loop learning because of its pre-defined problem space set by constraints and boundaries (Barrett, 1995; Avital, 2005). An operational elaboration on this point can be described through investigating the implications grounded in the root cause metaphor. The identification of a direct cause is done through objective and scientific reasoning and gives a good solution when the system is simple enough to attribute a direct mechanism to the effect (Ahn and Bailenson, 1996), but in a complex system (such as social systems) the direct cause will be based on normative logics that may or may not be useful for finding a countermeasure. This further argues for the iterative approach described by Rother (2010).

Strength-based Improvement

The prevalent approach to improvement within the strength-based perspective is Appreciative Inquiry. Appreciative Inquiry has been studied for development of organizations and applied as a change methodology for social systems (Cooperrider and Srivastva, 1987; Bushe and Kassam, 2005) as well as for a strength-based leadership perspective (Brun and Ejsing, 2012). The improvement approach that underpins Appreciative Inquiry is based on reframing the negative problems into an affirmative topic and thereby shifting focus from "what to eliminate" into "what should be created". The next step in the process is to create momentum from the best of what already is in place and gives life and move forward toward a positive future image. Appreciative Inquiry suggests an iterative and experimentation approach based on design and improvisation rather than relying on plans and formal decisions. Appreciative Inquiry is based on five principles that explain the reasoning behind the improvement process (Cooperrider *et al*. 2008): *The constructionist principle* states that reality is socially constructed by multiple perceptions and thus everyone should be part of an imaginative inquiry to create change such as discovering strengths in the system. *The poetic principle* states that organizations are continuously re-interpreted and re-constructed by the narratives told and that the issues that get attention will grow in peoples' minds, and it is therefore more rewarding to strengthening when the system is most alive instead of where it is least effective such as investigation of the causes for undesired action. *The simultaneity principle* states that the questions asked begins the change process and that analysis thus cannot be isolated from implementation. *The anticipatory principle* states that actions are guided by images of the future, i.e. positive images create positive actions. T*he positive principle* states that building and sustaining momentum for change requires positive affect and social bonding such as hope, excitement, inspiration, and urgent purpose. These principles are conceptualized as an improvement process called the 4D model (Cooperrider *et. al*., 2008) that often has five steps: 1) Reframing the

opportunity or problem by defining an affirmative topic choice. 2) *Discovery* of factors that previously have led to success in achieving the affirmative topic. 3) *Dream* and envisioning of guiding positive images of the desired future state and results. 4) *Design* and co-creation of actions and structures to realize the desired future state. 5) *Destiny* by building momentum for further implementation of the change process.

The Appreciative Inquiry improvement process is illustrated schematically in figure 6. The first step is shown in the top left and is reframing the problem (or opportunity) into an affirmative topic, the second step is to identify success factors and the best of what already is, then imagination of the desired future state (dream). The third and fourth phases are realization of the change based on the strengths and dreams identified, and often by an improvisational action phase based on voluntary individual engagement.

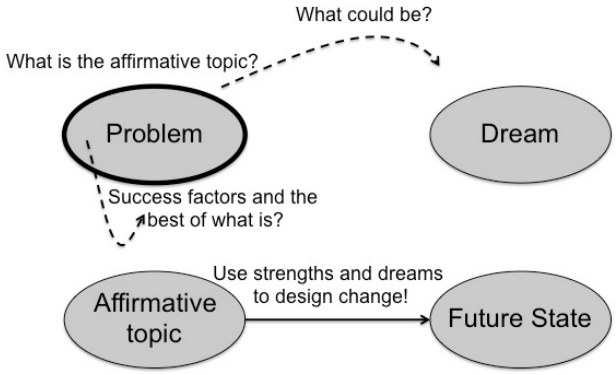


Figure 6: A schematic illustration of the basics in an Appreciative Inquiry problem solving process.

According to Grant and Humphries (2006) there is very little critical analysis of Appreciative Inquiry in the literature. Bushe (2012) divides the critique into three waves: 1) Focus on what is working will not give as good diagnosis as investigating both the functional and dysfunctional, 2) the focus on positive questions leads to an uncritical approach that claims monopoly on the truth and what is allowed to be said, and 3) the inquiry into positive experiences in the discovery phase may invalidate participants' negative organizational experiences and thereby repress potentially productive conversation.

Most Appreciative Inquiry literature stresses the positive organizational effects on relations and learning that are created during the process and that it creates more innovation compared to problem solving that focuses on eliminating things or fixing the current state (Barrett, 1995; Avital, 2005; Shendell-Falik et al., 2007). A deeper analysis into the process steps yields insights about how it leads to improvements. The first step of moving from a problem statement into an affirmative topic choice and the subsequent change of language means that the solution space opens up. Instead of looking for a solution within one technological trajectory, there is now a possibility to change to another trajectory (e.g. illustrated as a new innovation S-curves; Christensen, 1998). The importance of this shift in focus and language can be described by a quote by Wittgenstein (1921, p. 149): "*The limits of my language are the limits of my world*." As an explanation Gergen (1978) argues for the importance of the language in the social constructing of our reality and that the generative capacity needed to alter our world is "*the capacity to challenge the guiding assumptions […], to raise fundamental questions […], to foster reconsideration of that which is taken for granted and thereby furnish new alternatives for social actions*." This argues for considering that the language not only describes the problem but also forms and guides the possible future trajectories and solution space.

The second step of discovering success factors instead of root causes of failure not only creates an opportunity for turning tacit knowledge from a broad range of organizational members into explicit knowledge that can be used in the improvement activity (as described by Nonaka, 2007) it can also improve learning as exemplified by the Kirschenbaum *et al*. (1982) who state how positive self-monitoring leads to faster improvement than negative self-monitoring, a finding that Barrett (1995, p. 40) calls affirmative competence.

The third step of driving change through positive future images can also improve the generative capacity of the social system. Cooperrider (2000) explains the improved capacity as being analogous to the Pygmalion effect (see Rosenthal, 1994) where a significant improvement in performance can be achieved by only changing expectations, and analogous to the Placebo effect known from medicine research (e.g. White, Tursky, and Schwartz, 1985). These perspectives show how the Appreciative Inquiry improvement process can lead to double loop learning by opening up the solution space and creating generative capacity.

Literature Combining Lean and the Strength-based Perspective

In order to analyze if they can be combined and to get knowledge about Appreciative Inquiry in an operations management context a literature review was carried out. The findings are summarized in Table 1, and reveal that no papers discuss Appreciative Inquiry in operations management or with Lean and only few in a technical context.

Table 2: Summary of Literature Review on Appreciative Inquiry and Lean problem solving.

Search Term	Total hits in databases	Papers with content match	References
"Appreciative Inquiry" AND "Operations Management"	0 hits	0 hits	N/A
"Appreciative Inquiry" AND "Lean"	0 hits	0 hits	N/A
"Appreciative Inquiry" AND "Process Improvement"	10 hits	3 hits	Baaz *et al.* (2010); Holmberg *et al. (*2009); Ncube and Wasburn (2008).
"Appreciative Inquiry" AND "Continuous Improvement"	4 hits	2 hits	Cuyvers (2010); Barrett (1995).
"Appreciative Inquiry" AND "Engineering"	6 hits	2 hits	Phlypo (2008); Reed *et. al.* (2002).
"Appreciative Inquiry" AND "Problem Solving"	31 hits	4 hits (no replicates)	Shendell-Falik *et al. (*2007); Peele (2006); Avital (2005); Neilsen (2005).
Total hits (w/o replicates):	**42 hits**	**11 hits**	

Literature search was carried out in the databases EBSCO Host Academic Search, EBSCO Business Source Premier, and Thomson Reuters Web of Knowledge for journal papers and conference proceedings. Search date: 30th of March 2012.

The reviewed literature offers a one-sided discussion about the advantages of Appreciative Inquiry compared to problem solving. The arguments emphasize that a problem solving mindset can lead to defensive posturing (e.g. through perceived blame) that discourage action and creative thinking (Barrett, 1995; Neilsen, 2005; Shendell-Falik *et al.*, 2007), as well as inhibit knowledge generation in collaborative work (Phlypo, 2008; Baaz *et al.* 2010). It is argued that Appreciative Inquiry creates better opportunities for improvement and collaboration and creates enthusiasm and commitment to the organization, while problem solving does not foster excitement, enthusiasm or generate innovation beyond the defined problem's parameters (Shendell-Falik *et al.*, 2007). The

latter argument is supported by Avital (2005) who argues that problem solving is limited as it starts from a defined problem space set by constraints and boundaries where the solution is coming from within the alternatives in these limitations. Barrett (1995, pp. 37) adds: "accepting the constraints that generated the problem rarely leads to a permanent solution; instead, it often leads to patterns of coping." In contrast, Appreciative Inquiry uses affirmative reflection and positive affect to lift up the search for ideal possibilities where the most desired solution is picked (Avital, 2005), since the positive emotions expand thought-action repertoires leading to wider solution spaces (Fredrickson, 1998; Losada and Heapy, 2004). Peelle (2006) adds to the discussion a quantitative quasi-experiment that showed Appreciative Inquiry to enhance post task group potency and group identification compared to creative problem solving. Barrett (1995) stresses the importance of generative learning and thinking outside the accepted limitations, and argues that Appreciative Inquiry creates better learning systems that possess affirmative competence (being able to appreciate positive possibilities and strengths), expansive competence (challenging old habits with higher ideals that inspire to action), and collaborative competence (ongoing dialogue with diverse perspectives). Neilsen (2005) on the other hand suggests that nothing is wrong with problem solving *per se:* When carried out well it creates great collaboration and experiences of people at their best, but he argues that change processes require secure organizational attachment that are often not established during problem solving. It is therefore not the improvement process of Appreciative Inquiry but the initial interventions of creating mutual trust that is key to its success.

The presented views summarize to three categories that Appreciative Inquiry as improvement approach in operations management can contribute with: 1) More enthusiasm and commitment to change, 2) more open and creative thinking with wider solution spaces, and 3) more generative learning systems.

Only a few studies discuss the use of Appreciative Inquiry for technical improvements (Avital, 2005; Holmberg *et al.,* 2009; Hansen, 2010; Cuyvers, 2010; Baaz *et al.* 2010). It is suggested that a combination of Appreciative Inquiry and problem solving may be rewarding for opening up for more learning occasions by focusing on analyzing both situations of excellence and challenge (Baaz *et al.*, 2010), that it can lead to increased improvement in quality management by shifting focus from quality control to quality development (Cuyvers, 2010), and that it can increase proactivity of continuous improvement while still avoiding an overly positive focus at the expense of shortcomings and important underlying organizational problems (Ncube and Wasburn, 2008). Holmberg *et al. (*2009) suggest that Appreciative Inquiry may be inhibited with experienced problem solvers such as engineers and software developers due to their appreciation for solving problems and that they struggle with expression in appreciative terms and with exploring hopes and dreams collectively, and that an acknowledgment of the value of problem solving may be useful for introducing Appreciative Inquiry in these environments. Kongsbak (2010) adds that Appreciative Inquiry can be used as a large-scale intervention together for production system innovation (*i.e.* the Appreciative Inquiry Summit; Ludema et al., 2003) and Shaked (2010) adds how it can be used in *kaizen* events for specific process improvements.

Recently, two more publications can be added to this list: A PhD thesis that combines strength-based approaches and process improvement (Dayton, 2012) and a practice focused book on Strength-based Lean Six Sigma (Shaked, 2014).

This review shows that the discussion of the effectiveness of improvement approaches is only vaguely grounded in theory and that arguments do not use a clear unit of analysis, which means that the discussion is anecdotal and un-validated. This further stresses the need for a clear unit of analysis in an improvement theory in order to decode the productivity code.

2.4 Unit of Analysis for a new Improvement Theory

The theoretical perspectives on continuous improvement and the presentation of the two improvement approaches show that the theory is fragmented and that the lack of a common unit of analysis makes it difficult to discuss the effectiveness of different improvement approaches. This section presents such a unit of analysis that can serve as the basis towards a new improvement theory.

The presented theoretical perspectives in section 2.2 show very different units of analysis: Routines and meta-routines, organizational problems, individual's knowledge and habits, intergroup relations and management, and organizational processes.

Based on a workshop series over a two-year period with researchers from the Department of Management Engineering at the Technical University of Denmark, a unit of analysis was constructed that was able to address all of the other perspectives' units of analysis. The unit was an operational work system. The work system is an organizational subunit that transforms inputs into outcomes based on a work process. The work system should be based on design criteria that relates to an organization's strategy and in that way relate to the environment.

Inspired by open systems theory (Nadler and Tushman, 1980) and organizational ergonomics (through the work of Smith and Sainfort, 1989; Carayon and Smith, 2000; Kleiner, 2006; and Edwards and Jensen, 2014) the work system framework was developed. The framework is shown in Figure 7.

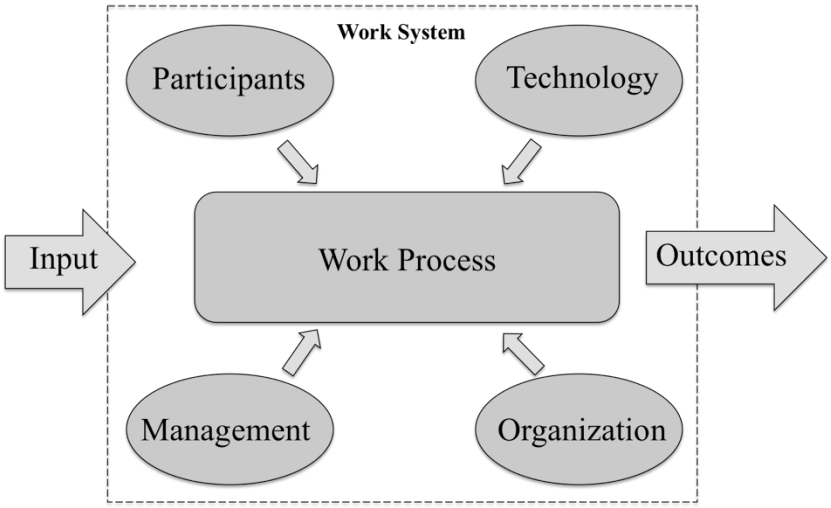


Figure 7: Work system as the unit of analysis.

The literature on organization theory offers many views of organizations (e.g., Morgan, 2006), but few are focused on the work process that transforms inputs into outcomes, which is necessary to address all of the requirements of a unit of analysis.

The work system framework describes how inputs are transformed into outcomes (outputs and side-effects) through a work process based on how the four elements interact. *Participants* refers to the human resources who participate in the transformation process with their action and knowledge. *Technology* means the artifacts, workspace, and methods (such as procedures and mental models) that are used. *Management* means the coordination activities, actions, and explicit expectations from formal and informal leaders that influence the transformation process such as goals, incentives, language, and meaningful interpretations (Weick and Quinn, 1999) and relational coordination (Gittell, 2000). *Organization* means the formal and informal structures, rules, culture,

and relational aspects that influence the transformation process in action, such as hierarchy, levels of trust, norms of behavior, and social capital (Adler and Kwon, 2002). The formal work process can be defined as a designed sequence of tasks aimed at value-added transformations of inputs – material and information – to achieve intended outputs (Upton, 1996). The actual work process is the actual activities performed, formal as well as tacit that use the interactions between the four other entities to transform inputs into outcomes, i.e., the operating routines (as viewed by the French-speaking ergonomics tradition, e.g., Danillou, 2005).

This choice of unit of analysis is able to embrace theoretical perspectives of dynamic capabilities since the work process describes routines, individual learning in the participant element, and social capital in the organization and management elements. It can also embrace the organizational learning perspective in terms of investigating how outcomes lead to feedback and initiate improvement activities that change the work system. An illustration of how improvement activities relate to the work system is shown in Figure 8.

Improvement with this unit of analysis is the change of a work system from one state to another state that makes the operational work system more efficient or effective in reaching its goals or leads to more desirable side effects. Improvement activity is defined as an activity where one or more people work on creating an improvement of the work system and may either be time-limited or built into the work process.

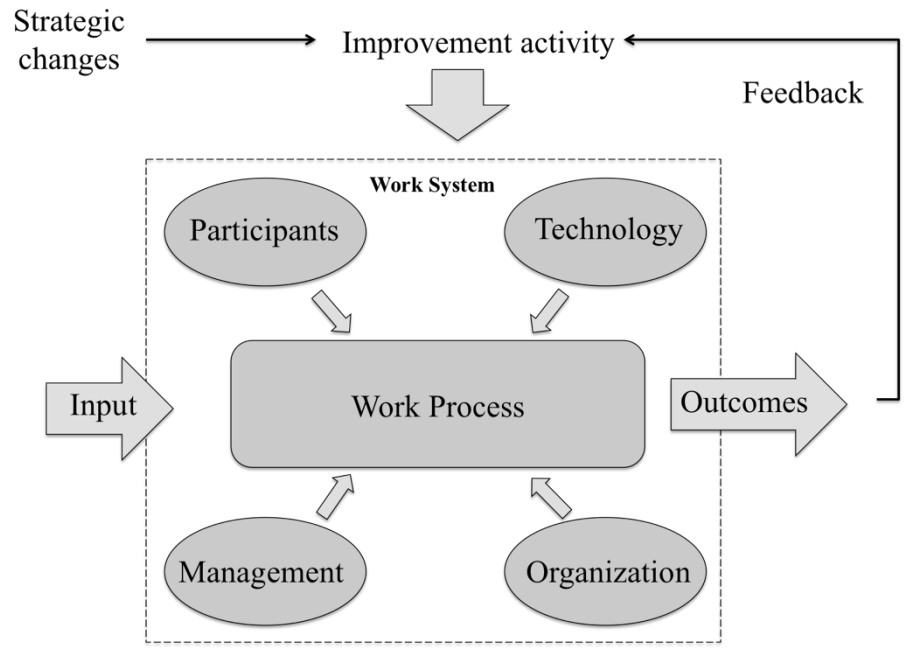


Figure 8: Improvement activity and the work system.

Although the work system framework looks like a static system when it is illustrated, it should be understood as a representation of the process of organizing. As proposed by Argyris and Schön (1976) organizational improvement should not be understood and analyzed as a static entity called an organization, as it is merely a representation, but research should rather be concerned with the active process of organizing. This process includes the use of individuals' theories-in-use that act analogous to grammar and guide the organizing process. Thus, the work system only exists as an entity when it is in action. Analysis should thus not just be slice of time, but rather through understanding the actual work process and its natural variations over time. These variations are due to variations in inputs from the environment as well as variations in how the participants interpret

how to use the technology and act according to the leadership expectations and organizational norms. Therefore the work process will fluctuate and have varying outcomes such as product quality, amounts of waste, and organizational learning.

A brief ontological discussion can clarify the unit of analysis in terms of this aspect. A positivistic view would argue that the organizational entities behave according to rational principles that can be understood by breaking the elements down into parts and using scientific methods based on empirical research (Taylor, 1911; Simon, 1946). A social constructionist view would argue that the organizational entities do not behave according to predictable principles nor do they exist isolated from the human beings, but instead their existence is based on communal rationality created by social construction (Gergen and Thatchenkery, 2004). A critical realist view would consider both of these views too superficial, unrealistic, and anthropocentric (Alvesson and Skjördberg, 2009) and suggest an alternative ontological view where intransitive objects exist that follow causal structures which endure and operate independently of mental activity, and where human knowledge is seen as transitive objects based on the social character of science (Bhaskar, 2008).

Based on this understanding, the different entities of the work system framework can be said to follow one or a combination of the following natures:

1) Mechanical (intransive) objects that follow causal structures with explainable mechanisms, and
2) Interpretive (transive) objects that are socially constructed and create action based on the on-going social interpretations.

An example of a purely mechanical entity in the work system is an injection moulding machine that transforms input into a physical plastic product based solely on the inputs such as the raw material, temperature, pressure, humidity, processing time, etc. A different interpretation of the role of the machine will not change the mechanisms that leads to the outcomes only a change in inputs will create an impact.

An example of a purely interpretive entity is an organizational hierarchy that guides communication, coordination, and decision-making during the work process. Even though the hierarchy can be represented on an organizational chart the influences on the work process and its outcomes solely depend on how the participants interpret meaning during the activity and then choose to react. If the hierarchy is formally changed but the participants do not change their interpretations it will not have any effect. Only changes in the socially constructed interpretations will have an impact on the actual work process.

Other entities will have both natures and be influenced by the constant human re-interpretation going on during the work process and by the scientific logics, such as following standard work procedures, reacting on management-by-objectives information systems, etc.

2.5 Towards a new Improvement Theory

This chapter has clarified the existing theory on continuous improvement. It has shown that the theory is fragmented, yet rich on different theoretical perspectives. The current theory describes numerous elements that influence the improvement capability of an organization, for example individual learning, organizational learning, meta-routines, and relational coordination, i.e., process perspectives, but only limited content on structural aspects. The perspectives in the current theory are difficult to compare and discuss due to the fragmentation of the perspectives, and in particular, the different units of analysis. Therefore existing theory is essentially not able to guide practitioners

on how to achieve improvement capability and what methods to use for what. The productivity code cannot be decoded by the existing fragmented theory.

The analysis of different theoretical perspectives on continuous improvement clarified a research object for the project. The research object is a unit of analysis that encompasses the different units of analysis for the theoretical perspectives, i.e. the work system framework. The framework consists of a work process, participants, organization, management, and technology. The presented theoretical perspectives used with regards to the work system framework shows that improvement activities happen closely related to the work system but as a separate activity (as described by Bessant and Francis, 1999; Anand et al., 2009). This unit of analysis can be a stepping-stone towards a new improvement theory for decoding the productivity code.

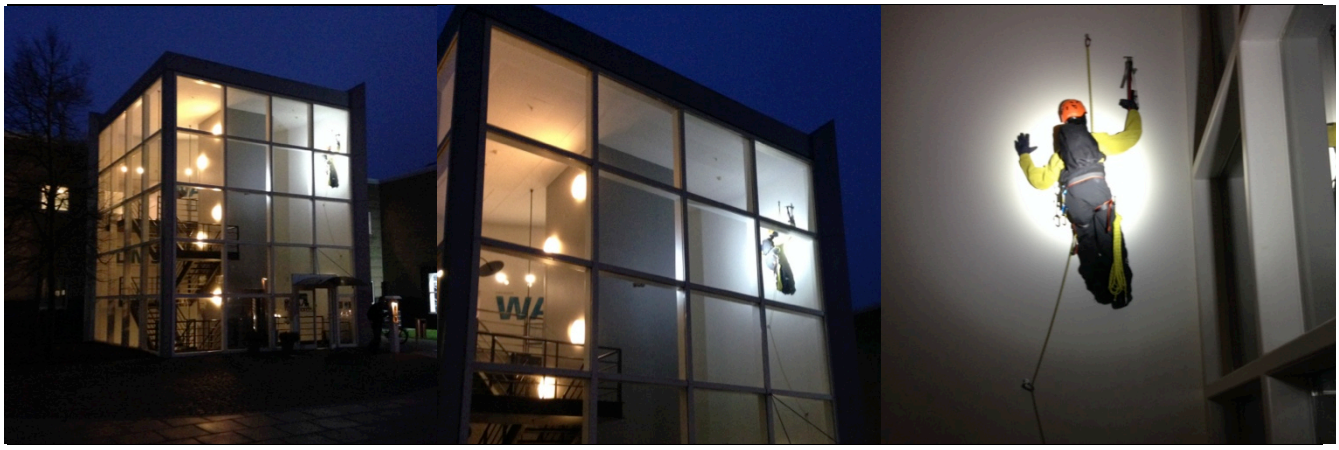
The productivity code posed two sub-questions: First, what is organizational capability for sustainable continuous improvement? Second, how should organizations acquire this capability, i.e., what is the necessary organizational transformation for achieving the organizational capability for sustainable continuous improvement? The following chapter will present the research design used to address these two questions.

3. Research Design

The aim of this research project is to contribute with new knowledge to decoding the productivity code of enabling sustainable continuous improvement in organizations. The project collaboration between the Technical University of Denmark, Resonans and Novo Nordisk gave opportunities for many different for research designs. The most exciting, however, was the combination of wide access within Novo Nordisk in the midst of a transformation process and the access to a reflective space at the University and improvement experts at Resonans. This combination made it possible to design the research project a longitudinal action research where research questions were answered through a collaborative and engaging process between the three parts.

Novo Nordisk as case company provided an excellent setting for an action research in continuous improvement because they were currently engaged strategically with creating improvement capability and at the same time they were open to experiment with their approach. Also, the long-lasting relationship between the case company and Resonans gave an effective stepping-stone for an action research approach. Furthermore, a shared excitement and curiosity for combining Lean and the strength-based perspective allowed the research project to explore unknown territory. Thus, the action research design made it possible to get inputs for solving the productivity code theoretically through engaging in solving the code in a particular case context.

This chapter will present the project's research design and its methodological considerations. First, the research questions are presented. Second, the case company is described to highlight the opportunities and limitations for the project. Third, methodological challenges are discussed and the chosen methodology presented. Finally, an overview of the different research activities of the project is outlined.



3.1 Research Questions

The overall research agenda of investigating how to make organizations continuously improve to achieve sustainable organizational performance implies two sub-questions, as presented in the theory chapter. The first question is to investigate what the organizational capability for sustainable continuous improvement comprises. The second question is how organizations should transform to acquire this capability.

Because the case company was in the middle of a strategic transformation towards continuous improvement capability they were interested in both research questions.

The theory chapter illustrated that there is no coherent improvement theory for continuous improvement and that the existing theoretical perspectives use different units of analysis, which make them difficult to compare. Since the theoretical perspectives did not demonstrate any clear answers to the first sub-question, practical questions appeared in the action research dialogues with the case company. These dialogues revealed questions on several levels that needed to be answered. First, what strategic considerations should be answered in order to achieve sustainable continuous improvement capability? Second, how should the improvement capability be organized, and third, how should it be managed operationally?

These considerations led to the formulation of three research questions for answering what organizational capability for continuous improvement comprises:

RQ1: How should organizations address continuous improvement capability strategically?

RQ2: How should continuous improvements capability be organized?

RQ3: How should improvement leaders facilitate sustainable organizational performance?

Since the three research questions are at a strategic, tactical, and operational level, they were considered to adequately address the needs of an entire organization, hence illustrated in an organizational triangle. However, they do not answer the other central question posed in the theory section, how organization's should transform from their current state and into their desired future state. This lead to a fourth research question:

RQ4: How should organizations transform to achieve improvement capability?

The four research questions were relevant questions in order to help the case company with their practical challenges of achieving continuous improvement capability, but they were also relevant questions for decode the productivity code at a theoretical level. The four research questions are

illustrated in Figure 9 and related to their role in turning the existing theoretical perspectives on continuous improvement toward a more coherent improvement theory.

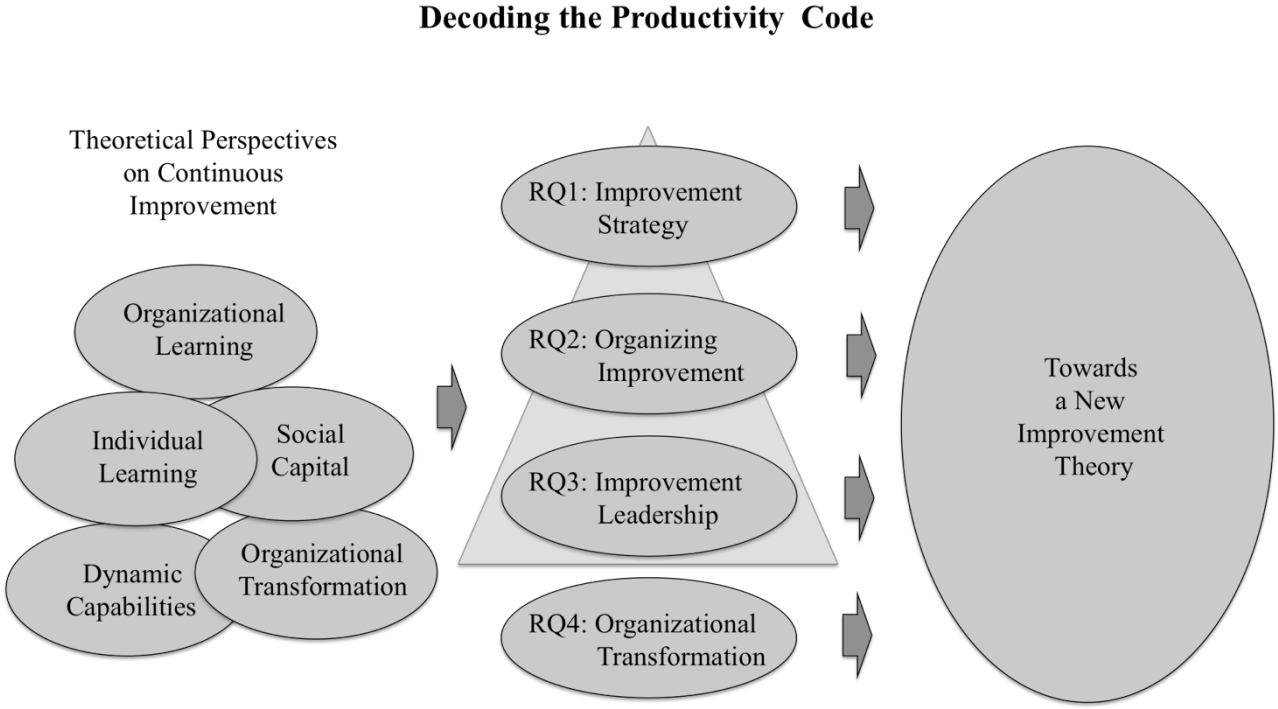


Figure 9. Research questions for decoding the productivity code.

	**From a Single Ascent to Expedition Mindset**	

3.2 The Case Company

The research project was established as an industrial PhD program with Novo Nordisk Device Manufacturing and Sourcing as a partner. Device Manufacturing and Sourcing is a department of the large Danish pharmaceutical corporation Novo Nordisk. Novo Nordisk is the leading diabetes care provider that excels largely because of their market leading medical devices. Device Manufacturing and Sourcing is located in one building at a larger Novo Nordisk site in Denmark. As the name implies, the department is responsible for manufacturing of the medical devices as well as sourcing of materials and parts. They are part of a global value chain and manage activities at other device manufacturing facilities around the globe. In order to get a manageable research scope, the project was focused on one part of Device Manufacturing and Sourcing: the production department and its relation to the Danish facility. In the thesis the term facility will be used to describe this Danish manufacturing facility with emphasis on the production department.

The industrial PhD program allowed wide access within the facility to observe and interview anyone at any time, and access to internal documents and data such as employee satisfaction surveys. The investment in the project through being a partner in an industrial PhD program also ensured the buy-in for participation, which led to continuous dialogue between the researcher and managers. This dialogue iteratively adjusted the research activities to optimize mutual benefits.

In this section, I will share the facility's background story to share the context of the study and then describe how this context supported the research design.

Background: The Dramatic Turn Around

In 2005 the facility experienced very high employee absence and low productivity. They struggled with handling the situation and after a while they decided to contact an external consultant to get help with the employee absence.

The consultant was Henrik Kongsbak from Resonans, who based his approach on the strength-based perspective. He decided to reframe the problem of sick absenteeism by the surprising question "if your facility is an ultimate success in two years, how will it look?" The managers suddenly realized that the problems probably were related to something they had not considered. They expected the facility to close down when they had phased out their current product. The facility management then decided to follow the consultant's advice to initiate a change project through Appreciative Inquiry and to mobilize the entire system in addressing the problem, i.e., to create an attractive burning dream instead of being inactivated by the burning platform. They used a variant of the Appreciative Inquiry Summit (Ludema et al., 2003) to engage the whole facility in creating the dream of being 'most wanted as facility and employees' and starting up initiatives to

achieve this dream. After 6 months they managed to turn around the situation and lower the absenteeism by 50 %, raise productivity by 44 %, and cut marginal costs per product by 17 %. The ultimate success was realized when the facility succeeded in attracting a new product for production ramp up two years later (Kongsbak, 2010).

After having experienced Appreciative Inquiry successfully at the strategic level with the whole system, the factory management was motivated to make this improvement approach a natural part of their daily operational work. Since the company was committed to Lean they needed to combine these two approaches. Question thus began to turn up, such as: "How can strength-based approaches such as Appreciative Inquiry be integrated in the daily work processes in a company committed to a Lean production system?"

One purpose for initiating the project is illustrated by a quote from the production director: "When technical problem solving for process improvement is the core of our work processes it is easy to fall back to a deficit-focused mindset that does not foster effective collaboration." They wanted to create more collaborative engagement and creativity that they experienced Appreciative Inquiry could enable. At the same time, the Lean problem solving approach with root cause analysis was experienced as very effective. They needed systematic problem solving to create the continuous improvements that were the foundation for the new product ramp up business plan at the facility. Systematic problem solving was a core strength they wanted to build on. The solution was therefore not to replace it with Appreciative Inquiry but to find out how to incorporate both thinking ways into the daily work with problem solving and continuous improvements.

The Ramp-up Facility: A Great Research Subject

The research project was initiated at the production facility in November 2010. The facility was in the beginning of the new product ramp up and they had realized that they not only needed to deliver a production target, but also to create efficient process improvement of the production system. The only way to survive with this type of production in a high wage country was to have a strategic focus on becoming a ramp-up specialist. This meant that the facility needed to master the combination of operating the manufacturing process and creating new work processes and optimize equipment. When the production system had been optimized the production would be outsourced to other countries while the facility could begin ramping up a new product.

This strategic challenge of becoming an effective ramp-up organization created great opportunities for the research project. The facility's management had already initiated the focus on creating continuous improvement capability based on Lean thinking, and they were ready to the next level. The time period of the research project was characterized by numerous changes at the facility, which created many opportunities for collecting data about all four research questions.

Headquarters became an additional driver for change due to a number of corporate programs that were introduced over the time period, as well as numerous leadership development programs the managers participated in. Also, all the managers at the facility had been selected to fit into the strategic challenge of transforming the organization into a capable continuous improving organization. Consequently, the company turned out to be an excellent case for studying the research questions, a living laboratory for development of continuous improvement capabilities.

These conditions made it possible to design a research project that learned from all the explicit reflections the company had in the time period and to follow interventions focused on organizational transformation. This inspired a research design as a reflective case study (Kotnour and Landeata, 2004; Brown et al., 2006; Farris et al., 2008; Liker and Morgan, 2011), which had embedded in it multiple cases of change in order to study the evolving development of the facility. Furthermore, the facility management's interest in creating continuous improvement capability and

their honest curiosity about how to do it invited for an action research approach. This meant that the researcher contributed actively to the development of the facility, which provided first-hand experience to reflect on.

Metaphoric development: From a Single Ascent to Expedition Mindset

The case company developed its thinking about continuous improvement capability over the time period. One example of this is their vision statements and how they developed. In 2006 the manufacturing facility introduced the vision "Most Wanted" with the purpose of showing enough improvement to survive, and they succeeded in attracting a new product.

In 2009 the facility formulated a new vision. They aimed for becoming "Best In Class", which implied excellence in processes through continuous improvement. The vision was accompanied by a guiding metaphor of a mountain climb with the peak being capable of producing 100 million units, as shown in Figure 10. This illustration shows how the facility considered their task as a journey of improving. The metaphor was used extensively to remind everyone that they not only needed to perform today but also needed to climb to the next level tomorrow. A number of artifacts were used to embed this thinking in the daily work with the most visible being a 2.5 m tall mountain placed in the facility entrance hall from 2009 to 2013. Along with the artifacts came a language of mountain metaphor language used in strategic conversations.

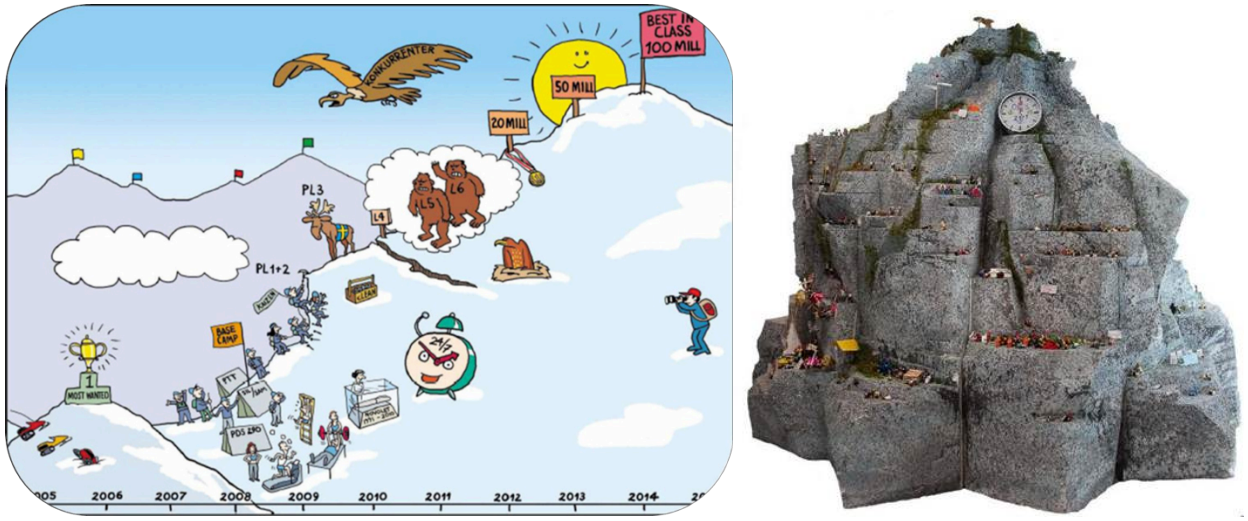


Figure 10. Best In Class vision and the 2.5 m tall mountain placed in the facility entrance hall.

In the end of the research project in 2013, a new vision and guiding metaphor was developed, the "Best In Class Expedition". This demonstrated that over the time period there had been a sophisticated shift in thinking and it was collectively developed and bought into. The new vision meant that the facility should be able to climb any mountain because it excelled in mountain expedition skills. In other words, they should have a generic capability for continuous improvement that would work for any new product ramp up. The implication of this new guiding metaphor was a clear focus on improving the improvement capability and not just realizing an ambitious single peak.

3.3 Research Methodology

The collaboration with the case company and their situation supported addressing the four research questions. However, there still remained inherit methodological challenges of researching this field.

Methodological Challenges

Liker and Morgan (2006) highlight a number of challenges for practicing and researching Lean, which include understanding the organization as a system and how learning cultures evolve. The challenges are further discussed in Liker and Morgan (2011), who present three main challenges to address in Lean research:

Lean is an emergent system: In order to be highly effective Lean requires integration of people, processes, and tools, which means that hypotheses of individual best practices cannot be tested since a systems view assumes complex interactions between variables. A reductionist view of isolated elements of the system will lead to misleading conclusions.

Lean is a dynamic evolving process: Measurement at one slice in time only represents a stop in the journey, thus research needs to be longitudinal.

Lean is an evolving culture: Lean should not be judged only on the structure of work processes since the culture is an essential feature of the system, and thus, people's way of thinking should also be captured.

They suggest future research to be based on in-depth cases studied over time with action research and non-deterministic research questions while looking for cultural shifts, e.g. in language or focus (Liker and Morgan, 2011).

Based on these reflections and the opportunities in the collaboration with the case company it was decided to approach the research project with an action research approach that matches the call for longitudinal, in-depth studies that take a holistic and systems focused view.

Research Approach: Dialogical Action Research

The research approach was decided to be action research (Argyris, 1983; Greenwood and Levin, 2011). Because the research questions were concerned with investigating a development process, the action research strategy possesses an advantage in its ability to help facilitate this development through active engagement by the researcher. The research approach was inspired by Maurer and Githens (2010) who introduce the notion of dialogical action research. Whereas the origins of action research have been synonymized with Lewin's (1947) famous 'un-freeze, transition, re-freeze' model the dialogical action research approach seeks to move beyond linear problem solving that

overemphasizes change as a short-term intervention brought about intentionally (as criticized by Weick and Quinn, 1999).

The dialogical approach implies that the researchers facilitate learning through discussions that catalyze reflective practices and double loop learning (Argyris, 1983). This also made the development process more explicit for the participants, which enhanced the researchers' ability to investigate the process. The research approach was also inspired by appreciative inquiry and emphasized making life-giving and successful practices explicit in order to reinforce desired behavior and to facilitate the development of new social realities (Cooperrider and Srivastva, 1987; Cooperrider et. al, 2008).

An implication of action research is the use of participatory data collection methods. These methods give access to otherwise inaccessible information by allowing researchers to explicitly look for issues and by influencing the respondents to better understand what to look for and how to think about issues. However, participatory methods also limit the quality of the data due to the bias of the researchers and the key informants (Kawulich, 2005).

Reflections on Data Collection

The research project reflects a desire to understand improvement more coherently than each of the fragmented existing theoretical perspectives meant that the data collection approach needed to be holistic. Where the research methods from social science such as grounded theory emphasize the participants' social construction of reality based on their words, an engineering setting to a larger extent also calls for understanding the technical system and the physical effects independent of what people "think about them". Thus, the study design needed to integrate different data collection methods for capturing both language and the non-spoken such as analyzing objects (e.g., Carlile, 2002). This holistic approach meant that the collected data was continuously reflected on and processed into memos, which were used for dialogues with the managers and thereby further data collection.

Based on these considerations of keeping a holistic view on the data collection it was decided not to carry out thorough interview analyses with transcription and coding since this would emphasize spoken words over observed actions

Data collection was carried out with multiple qualitative methods as summarized in Table 3. Observations and memos were collected in a field notebook and pictures were stored electronically.

Table 3. Data collection methods.

Method	Example
Interviews and dialogues	• Retrospective interviews. Key informants: Production manager, change consultant, former team leaders, experienced employees. • Semi-structured interviews and dialogues. Key informants: Production and production support team leaders and managers, Lean consultants, HR partner, and corporate vice president (head of facility).
Direct observation	• Performance board meetings • Management team meetings • Problem solving sessions and coaching sessions • Process confirmation and shop-floor management activities • Large events
Participant observation	• Training workshops • Continuous Improvement workshops • Meetings in the continuous improvement program team • Discussion workshops
Reflection sessions	• With Vice President, managers, team leaders, Lean consultants, HR partner, etc.
Document and object analyses	• Balanced scorecards and Key Performance Indicators • Performance boards • Problem solving tools and manuals • Internal Lean maturity model • Cultural artifacts such as the Best in Class mountain and strategy visualizations

3.4 Research Activities

The action research project had a duration of three years where data collection, processing and dialogue with the case company happened iteratively as described in the methodology section. The project was divided into a series of activities that took place in order to answer the research questions, summarized in Table 4.

The initial research phase was to grasp the situation, where I participated in numerous meetings to get an understanding of the organization and to learn about what was on their minds. I spent extensive time with the team leaders and the production department director as well as spent full working days with operators and technicians to get to know their work, their thinking, and their jargon. This was my time as a business anthropologist where I wrote lots of field notes and had lots of information-rich informal conversations. In the grasp situation phase I also did a survey of the organizational social capital and analyzed the internal employee engagement surveys to get an understanding of the state of the relational aspects of the organization.

The second phase was framing of relevant organizational challenges and research questions together with managers at the case company. This phase was continued throughout the entire project as the continuous dialogues provided answers and new questions.

The third phase was longitudinal study of the case company. Major events and activities that changed the continuous improvement capability were studied over the three-year period in order to get an understanding of the first and fourth research question. By participating regularly in activities at the case company and by doing interviews with managers and employees spread over the time period, a lot of data was collected during the longitudinal study.

The fourth phase was explorative in-depth studies, which consisted of a number of research projects that were initiated over the time period based on inputs from the dialogue sessions with the managers and discussions at the University. Sampling criteria for the in-depth studies was an assessment of their contribution to the four research questions. Some research projects were explored as a pilot study only, while others continued for more extensive research. One of the in-depth studies, the study of the 3-month implementation of a problem solving system, was used as input for the third research question.

The fifth phase of data analysis and conceptualization was an iterative phase just as the framing of research questions phase. The continuous data analysis and conceptualization utilized memos and discussion sessions to test conclusions and as input for further research. The analysis strategy was based on the experimenting nature surrounding the company simultaneously with its competitive environment that meant the company continuously developed new knowledge about improvement. This knowledge enriched the conceptualization phase through discussions with people from the case company as well as from Resonans and the University.

The sixth phase was in the winter of 2013, where I spent 4 months at the University of Michigan to get new perspectives on the research, to get inspiration from world-class scholars, and for visits to world-class companies for comparison. This phase served as time for reflection and writing.

The seventh phase was consolidation of the findings where I presented research and participated in discussion sessions at a number of academic conferences. Also, the findings were presented in the case company and for other companies to get feedback on its relevance.

The final phase was the concluding phase where the research was disseminated into academic papers, popular papers for practitioner journals and newspapers, and this thesis.

Table 4. List of research activities.

Project Phase	Research activities
Grasp situation	• Participation in management meetings • Observations with employees on their jobs • Survey on organizational social capital • Interviews on past events and experiences
Framing of research	• Discussion with managers on relevant challenges and research questions • Iterative process
Longitudinal study	• Study of the organization's progress over the 3-year period • Study of the operations strategy changes • Longitudinal interviews over the time period
Explorative in-depth studies	• Performance board meetings study • Problem solving and appreciative inquiry study • Organizational development 'follow group' sessions • Problem solving system study • Question framing study • Change events
Data analysis and conceptualization	• Theory development work • Dialogue sessions
Perspectives	• External research stay to get new perspectives on the research
Consolidation	• Presentations at conferences • Presentations at the company • Facilitation of workshops • Design of next level summit • Discussion with other organizations
Conclusions	• Paper writing • Thesis writing • Popular dissemination

These activities served as inputs to the answering of the four research questions posed at the beginning of this chapter. The data was used for the three papers and for the thesis as illustrated in Figure 11.

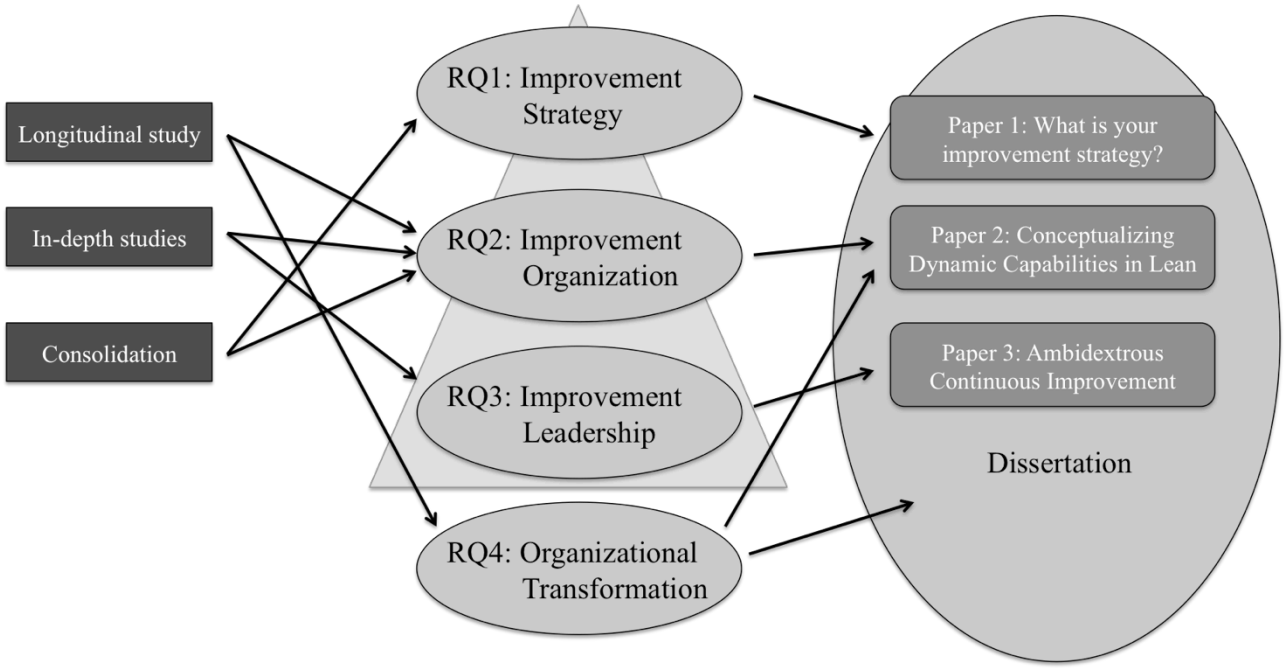


Figure 11. Selected research activities and their relation to the research questions and papers.

4. Findings

The findings of the research project have been presented in three papers that give an answer to the first three research questions. The first paper, "What is your improvement strategy?" discusses the strategic considerations for achieving continuous improvement capability. The paper presents different strategic approaches to improvement capability termed improvement strategies and discusses how they should be supported by different improvement methods. The second paper "Conceptualizing Dynamic Capabilities in Lean Production: What are they and how do they develop?" presents a longitudinal study of the case company, and of how they develop continuous improvement capability. The paper delivers a model that conceptualizes continuous improvement capability as the readiness for organizing an appropriate improvement system. Furthermore, the paper discusses how to improve its effectiveness. The third paper "Ambidextrous Continuous Improvement: A case study of Strength-based Lean Leadership" presents the operational leadership considerations for achieving sustainable organizational performance. The focus of the paper is on the capability to create contextual ambidexterity, i.e., the ability to concurrently use exploration and exploitation. This paper also offers an explanatory model for how improvement trajectory shifts happen and the mechanisms that inhibit or facilitate the shift.

I recommend reading the three papers prior to reading chapter 5 in order to get the full benefit from the discussion. The three papers are found in Appendix A, with revised versions to appear in journals once published. The rest of this chapter will briefly summarize the findings of the three papers in a structured extended abstract.

4.1 Paper 1 – What is Your Improvement Strategy?

Purpose – Continuous improvement initiatives are used everywhere and along have come numerous improvement methods based on the scientific method such as root-cause analysis. However, the focus on problem elimination and short-term results takes attention away from another central aspect of continuous improvement: strengthening of organizational improvement capabilities. The purpose of this paper is to investigate the strategic considerations necessary for achieving sustainable continuous improvement capability.

Design/methodology/approach – The paper is a conceptual paper that builds on theoretical work and practical experience from the longitudinal case study.

Findings – This paper offers a framework for selecting an improvement strategy that matches the organization's current need for realizing improvements or building competences. The paper also discusses the role of different improvement methods in achieving different improvement strategies and presents an empirically tested framework for designing improvement methods to match improvement strategies.

Practical implications – The paper shows how improvement efforts needs to address both realization efficiency and competence building in a different way. An improvement strategy should explicitly choose how to balance efforts; otherwise there will be pitfalls such as investment in competence without creating any returns or harvesting low hanging fruit without creating learning, thus missing long-term gains. Since different improvement methods develop realization efficiency and competence building differently, the methods should also be actively determined. Examples in the paper show how improvement methods can be designed to support different improvement

strategies and the paper presents a framework for designing methods for a particular improvement strategy. The art of defining and operating an improvement strategy is a key competence for successfully achieving continuous improvement capability for sustainable organizational performance.

Research limitations/implications – The findings of the paper are based on a conceptual discussion and the improvement strategy framework has not been empirically consolidated.

Originality/value – This paper provides a simple, yet powerful model for strategically considering improvement. Also, the paper is one of the first of its kinds to show how elements of problem solving and appreciative inquiry can be combined to achieve a more comprehensive improvement approach to daily improvement activities.

4.2 Paper 2 – Conceptualizing Dynamic Capabilities in Lean Production: What are they and how do they develop?

Purpose – Despite remarkable popularity of Lean, implementation efforts often emphasize the tools for designing an efficient work system rather than developing dynamic capabilities necessary for continuous success. This paper investigates how to develop sustainable continuous improvement capabilities in Lean production, i.e., dynamic capabilities. The purpose of the paper is first of all to conceptualize dynamic capabilities and secondly to investigate how dynamic capabilities develop.

Design/methodology/approach – The study was based on a longitudinal in-depth dialogical action research study at a manufacturing facility. In the period 2006 to 2013, a number of cases were investigated and used as data to conceptualize dynamic capabilities at the operational level and to explore how the facility developed dynamic capabilities.

Findings – The empirical study concluded that the facility developed dynamic capabilities and used them strategically to become a competitive ramp-up facility. The paper shows how dynamic capabilities develop as the organizational setting for improvement activities, termed *the improvement system.* This system comprised five elements: an improvement process, participants, management, organization, and technology. The paper shows how the effectiveness of the improvement system depends on the congruent fit among these five elements and also the bridging coherence between the improvement system and the work system through activation, information, and the implementation approach.

The analysis showed that the development of the improvement system required explicit focus on changing people's mindsets and behaviors through large-scale sense-making interactions, use of metaphors, and broad leadership development, rather than changing structures and procedures.

Practical implications – The findings show that continuous improvement capability can be conceptualized as an improvement system, which practitioners can use to design more holistic improvement efforts, rather than focusing on a single system element.

The findings also suggest that organizational transformation requires long-term commitment and simultaneous efforts aiming at different aspects. Furthermore, the study showed how a second order improvement system that continuously developed the first order improvement system is an approach for supporting the organizational transformation.

Research limitations/implications – The research was carried out in a single case organization and the findings have been consolidated by discussions in only three other companies. Thus, more research is needed to challenge the findings and their generalizability.

Originality/value – This paper gives much more operational description of improvement capabilities than offered by previous studies. The additional description of operational transformation to the dynamic capabilities theory can be used for more thorough design of improvement efforts.

4.3 Paper 3 – Ambidextrous Continuous Improvement: A case study of Strength-based Lean leadership

Purpose – Continuous improvement is a central discipline in operations management. However, prevalent continuous improvement approaches (e.g., Lean) have been criticized for leading to short-term efficiency while inhibiting long-term improvements. The solution to this problem is the organizational ability ambidexterity, i.e., the ability to improve performance by means of both exploitation and exploration. For decades, however, this ability has been acknowledged as an unresolved challenge due to the seeming incompatibility of exploitation and exploration. Yet, studies suggest that some companies utilizing continuous improvement do achieve ambidexterity. This paper investigates how this can be achieved by exploring the role of improvement leadership approaches. Two improvement leadership approaches were studied: Strength-based leadership and problem-solving leadership.

Design/methodology/approach – An explorative case study was carried out over a 12-month period at a manufacturing facility. The two improvement leadership approaches were investigated in-depth in ten improvement projects, lasting from a week up to two months. Qualitative data from observations and interviews was used to analyze whether the improvement leadership approaches did create contextual ambidexterity.

Findings – The paper shows how the improvement leadership approach determines whether improvement activities exploit or explore. The empirical study confirms that different improvement leadership approaches can co-exist within one organizational entity. These findings demonstrate how contextual ambidexterity can be achieved through explicit design of the improvement leadership approach, either through combining different approaches or by using one dynamic approach. Finally, the paper uses the empirical material to analyze the mechanisms that lead to exploration and exploitation, and presents a model for understanding contextual ambidexterity in relation to the improvement leadership approach. The model shows how exploration can incrementally change the improvement trajectories of work systems and, thereby, over time lead to radically improved performance. The study also shows that different improvement leadership approaches lead to different types of improvement activities. The problem solving approach primarily leads to exploitative activities, and the strength-based approach primarily leads to explorative activities.

Practical implications – The paper shows how practitioners can approach contextual ambidexterity through the improvement leadership approach, and presents a framework for customizing improvement approaches for various organizational needs. By developing a behavioral capacity in leaders to decide when to use what improvement approach, contextual ambidexterity can be achieved. This behavioral capacity can either be based on shifting between different improvement leadership approaches, or by using a dynamic improvement approach, e.g., Toyota's problem solving approach.

Research limitations/implications – The research was based on a single case study, which means that the findings may lack generalizability. Further research is encouraged to challenge the findings and to investigate them in other contexts. Also, the unit of analysis of this paper was the improvement leadership approach. Since one finding was that the role of facilitation made an impact, further research is encouraged using the skills of leaders as unit of analysis.

Originality/value – This paper is the first to investigate the improvement leadership approach as a vehicle for contextual ambidexterity. Also, the paper is the first study of strength-based approaches in operations management.

5. Discussion and Implications

The research project aims at answering four research questions in order to contribute to a more coherent improvement theory for continuous improvement. The first three research questions are discussed in three research papers in Appendix A. The three papers combined give an answer to how organizations can achieve continuous improvement capability for sustainable organizational performance. Additionally, the research project has yielded insights to the fourth research question that will be discussed further here.

This chapter will first discuss the four research questions from a practice-oriented perspective. First, how organizations should address continuous improvement capability strategically. Second, how continuous improvement capability should be organized. Third, how improvement leaders should facilitate sustainable organizational performance. Fourth, how organizational transformation should be addressed.

Finally, a discussion about how these findings can contribute to a more coherent improvement theory for continuous improvement will be presented.

5.1 How should Organizations Address Continuous Improvement Capability Strategically?

The first strategic question to ask in terms of continuous improvement capability is: "How much are we willing to invest in order to have effective continuous improvement?" Winter (2003) discusses the strategic considerations connected to investing in continuous improvement capability compared to reacting to changes. Most organizations will realize that they are in an environment where they should invest in some level of continuous improvement capability in order to stay competitive. The next strategic question to ask is: "How do we get the most dynamic capability in return for our efforts?"

The first paper discusses this question and shows how improvement efforts either can realize productivity improvement directly or build competence to create new improvement potential. Continuous improvement efforts should therefore consider how they balance these two dimensions of *realization efficiency* and *improvement competence*. Both are important but they are different dimensions that require different efforts and the optimal balance depends on the organization's current situation and operations strategy.

Realization efficiency is the amount of achieved improvement per improvement potential, e.g., the available ideas for increasing productivity, e.g., quality or efficiency, shorter lead times, less scrap, a better work environment, new products, etc.

Improvement competence is the organization's ability to identify improvement potential. Improvement competence can be quantified as the number of ideas times the average potential value per idea per time unit, e.g., potential value per day. Improvement competence thus depends on the engagement of people, their ability to identify problems and opportunities, on analytical skills, and on organizational elements such as management, coordination, alignment between improvement goals and organizational direction, etc.

An organization's improvement capability is a result of both the realization efficiency and the improvement competence. Mathematically the rate of improvement is the product of these two dimensions as realization efficiency has the unit improvement effect per potential and improvement competence has the unit potential per time unit. The product of the two units is improvement effect per time unit.

An organization cannot focus all efforts on realization without losing focus on competence building and vice versa. Consequently, an explicit choice of where to focus efforts should be made, which yields an improvement strategy. Four generic improvement strategies can be defined by making a two-by-two matrix of the two dimensions, as shown in Figure 12.

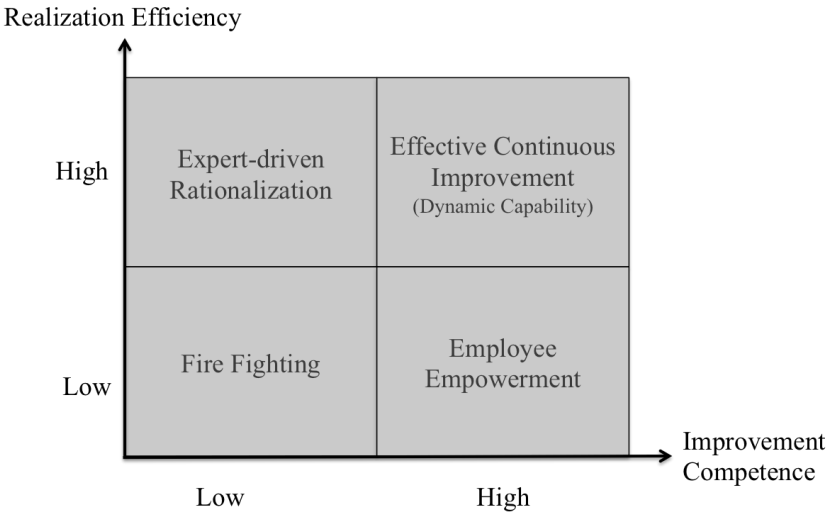


Figure 12. The improvement strategy framework and four generic improvement strategies.

Figure 12 shows four generic strategies: *Expert-driven Rationalization* means focusing on immediate realization over competence building, *Employee Empowerment* means building competence with limited focus on realization, *Fire Fighting* means reacting to changes when they come without investing in realization efficiency or competence building, and Effective Continuous Improvement means proficiency in both realization efficiency and improvement competence, i.e., dynamic capability.

A relevant strategic consideration for any organizations is where they would assess their current, and probably implicit, improvement strategy and where they would want to be in the future. The improvement strategy framework is a simple approach to assess an organization's current state and to decide a desired future state.

Discussions with a number of organizations on their improvement strategies revealed that many fall into one of two pitfalls. The first pitfall is the Human Resources trap of ineffective employee empowerment where all improvement efforts focus on creating new potential but only limited amounts are realized. The second pitfall is the rationalization trap of harvesting all the low hanging fruits by experts, which means that after a while the known improvement potential is harvested and the organization's employees are not able to identify new improvement potential because they were not a part of the harvesting process. Many organizations even report that they fall into both pitfalls for example by organizing their improvement efforts in silos or by shifting focus from one to another as a pendulum.

The solution for most companies is to move more towards a combined approach, even though it requires an investment. A combined approach would be *learning-by-doing*, which is also suggested by Liker and Morgan (2011) amongst others. This approach follows the guideline that every business challenge should be a people development challenge, and vice versa.

A good improvement strategy takes origin in the organization's current state and future need. For most organizations, who have overdone one dimension, this means to slow down in one dimension and use it to invest in the other. In that way, they could use the mountaineering saying: "Slow is smooth and smooth is fast!" Three examples of changes in improvement strategies are shown in Figure 13.

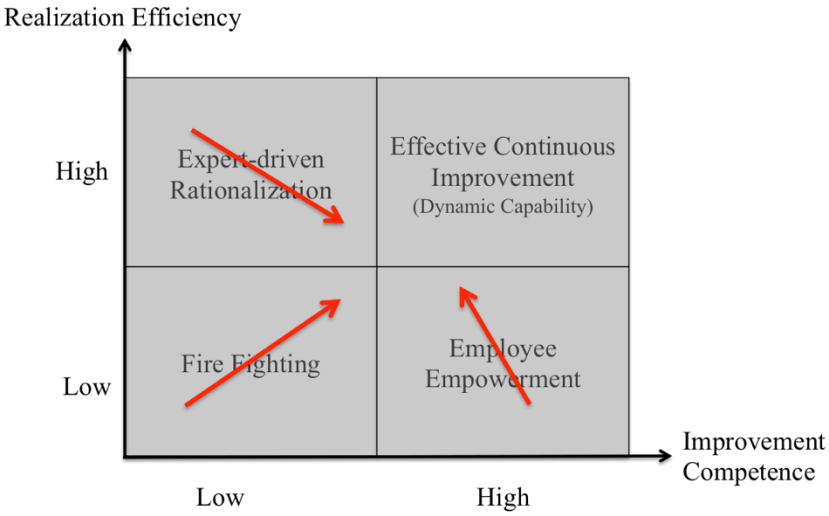
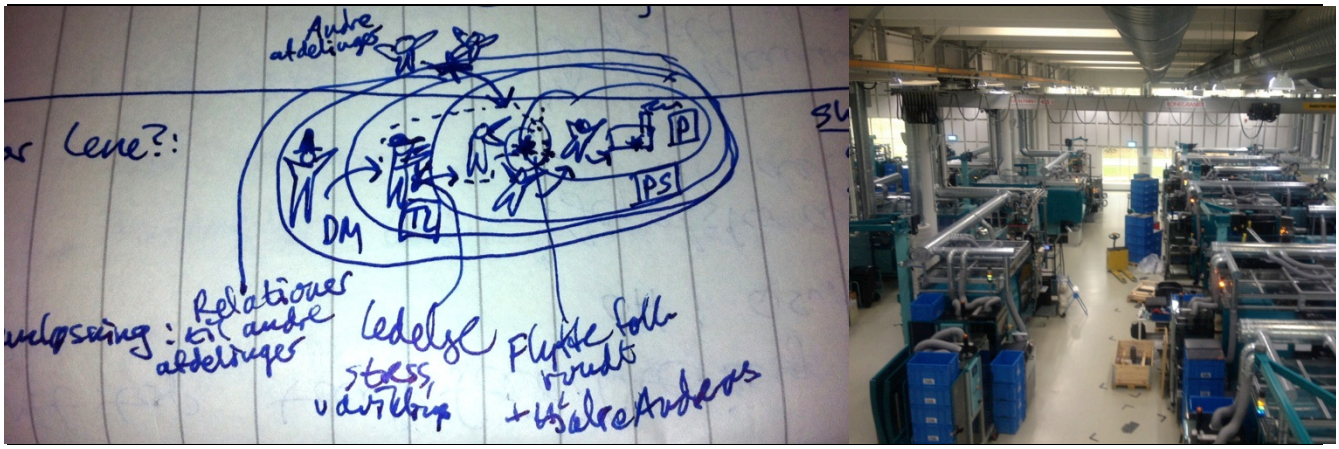


Figure 13. Changing improvement strategy toward effective continuous improvement.

After deciding on an improvement strategy that matches the organization's current state and future state desire, the next question is how to do it. The next sections will discuss how to organize continuous improvement capability in order to implement different improvement strategies.



5.2 How should Continuous Improvements Capability be Organized?

The second research question concerned how to organize continuous improvement capability. Continuous improvement is not just an activity, but rather a process in an organized system. The research paper "Conceptualizing Dynamic Capabilities in Lean Production: What are they and do they develop?" concludes that improvement capability is the organization's ability to organize and manage improvement activities, which is conceptualized in an improvement system. The improvement system is an analogy to the operational work system that has been used as unit of analysis and can be represented with the same elements.

An organization with an effective improvement system has gained preparedness for initiating and organizing effective improvement processes. This means that continuous improvement capability is not just a matter of competence in improvement methods, but rather a development of the ability to organize improvement activities coherently. The improvement system can be understood as the repertoire for organizing improvement activities. With a metaphor the improvement system is the grammar that underpins the language in use. A more coherent improvement system makes it easier to organize effective improvement activities, just as more coherent grammar makes it easier to create effective sentences and paragraphs.

An improvement strategy is realized through the improvement system. Improvement competence is the ability to initiate and process improvement ideas, and realization efficiency is the ability to process and implement solutions. Both dimensions are a result of how the improvement system is configured.

The effectiveness of the improvement system depends on two types of coherence: Bridging coherence and congruent coherence. Figure 14 illustrates an improvement system and its connection to the operational work system. In the following the elements that affect the two types of coherence will be presented.

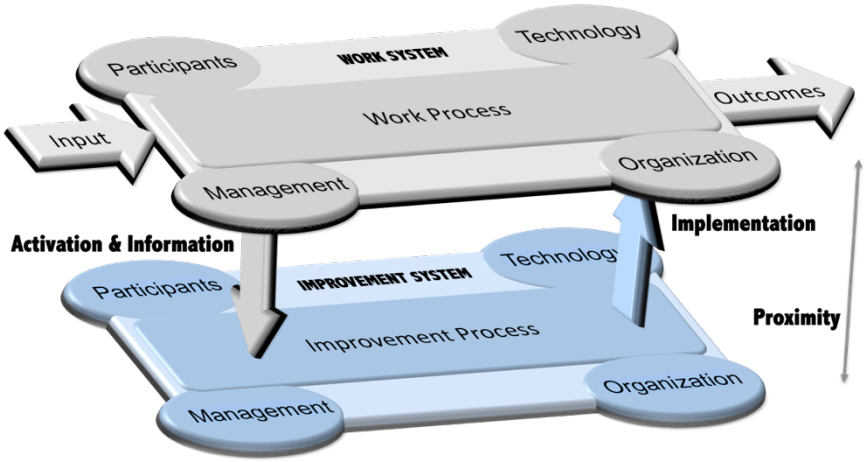


Figure 14. The improvement system and how it connects to the work system.

Bridging Coherence between the Systems

The coherence between the work system and the improvement system depends on five elements. First, *activation of the improvement system*: How is the improvement processes initiated? Activation can happen reactively through identification of positive or negative positive deviances in the work system or proactively by settings new targets in the improvement system.

Second, *information to the improvement system*: How and what information is available as input to the improvement system? Coherent systems have timely, frequent, and accurate communication between work groups (analogous to the relational coordination concept; Gittel, 2000). Effective information flow to the improvement system is not limited to up-front information but also availability for investigating the work system further. For example by involving the same people who do the operational work.

Third, *the proximity of the improvement system*: How close (physically and conceptually) are the work system and improvement system? An example of close proximity is when improvement work always happens at the shop-floor (Gemba) by investigating the actual machinery and talking to the actually involved people. An example of far proximity is improvement sessions at off-sites where abstract language and metaphors are used instead of the actual artifacts. Effective proximity depends on the challenge, where daily continuous improvement work should have close proximity and more explorative strategic changes more distant proximity. Coherence in this case means an adequate repertoire of proximities to choose between depending on the improvement task.

Fourth, *the frequency and duration of the improvement activities*: How frequently are improvement activities initiated and for how long do they last? Naturally, different types of improvement challenges require different durations. Coherent systems thus have a broader repertoire for initiating improvement activities with the right duration and frequency. However, they will normally also have a higher frequency and shorter duration of improvement activities to speed up improvement cycles and to ensure the relevance of the improvements. The less coherent systems will do the opposite, such as a few long lasting improvement activities.

Fifth, the *implementation approach*: How are improvements implemented and sustained? This factor may be the most important in terms of improvement system effectiveness. Where immature systems believe that an idea or a description of a solution is the basis for implementation, the mature improvement systems think differently. Coherent systems ensure that implementation not only involves changing the necessary physical artifacts to support the change, but also, that all the relevant participants have been involved in discussing the solution early in the improvement

process. In this way they have already started the implementation process long before the solution has been formulated. This implementation approach called Nemawashi in Japan (Liker, 2004) follows the constructionist principle from the strength-based perspective (Cooperrider et al., 2008). Furthermore, the coherent improvement systems take a long-term approach to implementation that emphasizes the necessary reinforcement of new behavior (as described by neuroscientists Rock and Schwarz, 2006). An example of this is to follow up implementation with training and process confirmation activities over a period of several months.

The presented five factors can be used to analyze the effectiveness of a current improvement system and to design a more ideal improvement system.

Congruent coherence within the system

A coherent improvement system is a well-organized system and requires congruent fit between the elements comprising the improvement system. The elements of the improvement system are the improvement process, participants, technology, management, and organization, as illustrated in Figure 17. Congruent fit means that the elements support the effectiveness of the improvement process, that is, when the improvement process is supported by competent participants, appropriate technology, management coordination, and is organized with synergies between different work groups.

Technology can enhance coherence when it provides effective methods for the context, provides an effective work space such as improvement boards with data, proximity to the shop-floor for looking at the actual situation, and adequate meeting rooms for the types of discussions, or provides effective tools and objects to support the particular improvement process such as boundary objects (Carlile, 2002) for discussing with people from different departments or software for simulations and calculations.

Participants can enhance coherence when they have the right competences and when they contribute with engagement and energy.

Management can contribute to coherent fit when their coordination activities support the improvement process, for example, by coordinating improvement efforts and providing adequate resources for the improvement process. One management pitfall that can inhibit congruent fit is when managers forget their coordination role and solve problems by themselves and short cut the improvement system's configuration. Managers can contribute positively to congruence by enhancing relational coordination by ensuring frequent, timely, and accurate communication, as well as contributing to shared goals, shared knowledge and mutual respect (Gittell, 2000).

Congruence between the improvement process and organization can happen through providing supporting structures. For example, by having high technical bureaucracy and enabling social structure, i.e., enabling bureaucracy (Adler, 1999). Also, the way roles and responsibilities are organized between different organizational entities can support the improvement process.

The congruent fit perspective gives a number of practical levers for optimizing an improvement system. The perspective emphasizes that elements need to fit together to be effective, and in particular, that they need to support the improvement process. This perspective can be used to analyze current improvement systems and to design a more congruent system optimized for the strategic need. For example, an improvement strategy with a need for higher realization efficiency may optimize elements to emphasize implementation such as through management focus, technology with performance monitoring, or by engaging participants with preferences for results. On the other hand, an improvement strategy that needs higher improvement competence may optimize the improvement system for this need by management that emphasizes reflection-in-action, technology that visualizes learning (issue trees, value stream mapping, etc.) and organize the improvement process with coaching of participants.

The Second Order Improvement System

The research project revealed that the case company established a second order improvement system during the time period. The purpose of the second order improvement system was to improve the first order improvement system regularly and systematically. The second order system, as opposed to just a second order activity, means the development of an organizational setting to support the activities. The development of the second order system made it possible to accelerate the development of the first order improvement system, although it required an additional investment to establish and sustain. The work system and the two improvement systems are illustrated on Figure 15. The second order improvement system's bridging coherence with the first order improvement system is analogous to the coherence between the work system and the first order improvement system. However, due to the fact that the improvement process is even more abstract and has fewer physical artifacts than the work process, the second order improvement system required even closer congruent coherence to be effective.

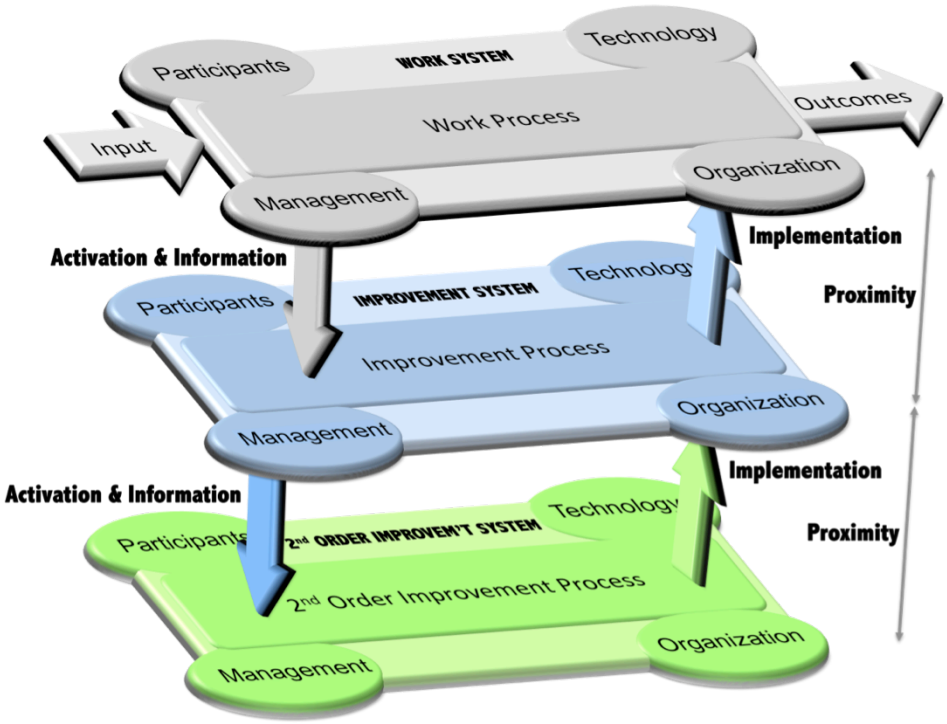


Figure 15. The work system, improvement system and second order improvement system.

This systems understanding of continuous improvement makes it possible to iteratively analyze and design continuous improvement efforts depending on the improvement strategy. The more need an organization has for continuous improvement capability the more coherence it needs to create between the improvement systems. Figure 16 shows the relation between the desired continuous improvement capability and the need for established improvement systems.

Furthermore, the two dimensions of realization efficiency and improvement competence can be managed through the configuration of the improvement systems. Higher realization efficiency can be acquired by configuring the improvement system for implementation and higher improvement competence can be acquired by enhancing the activation capability and the improvement system's congruent coherence, i.e., how well the elements support each other.

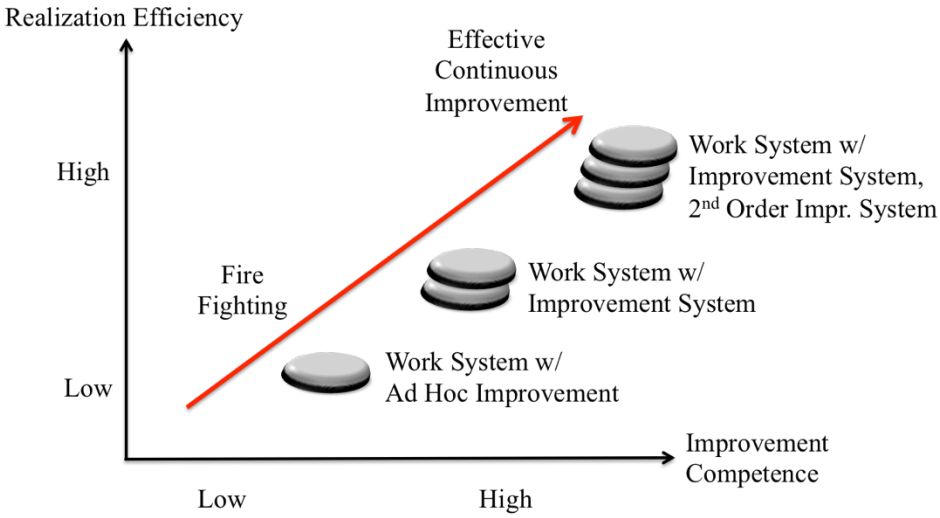
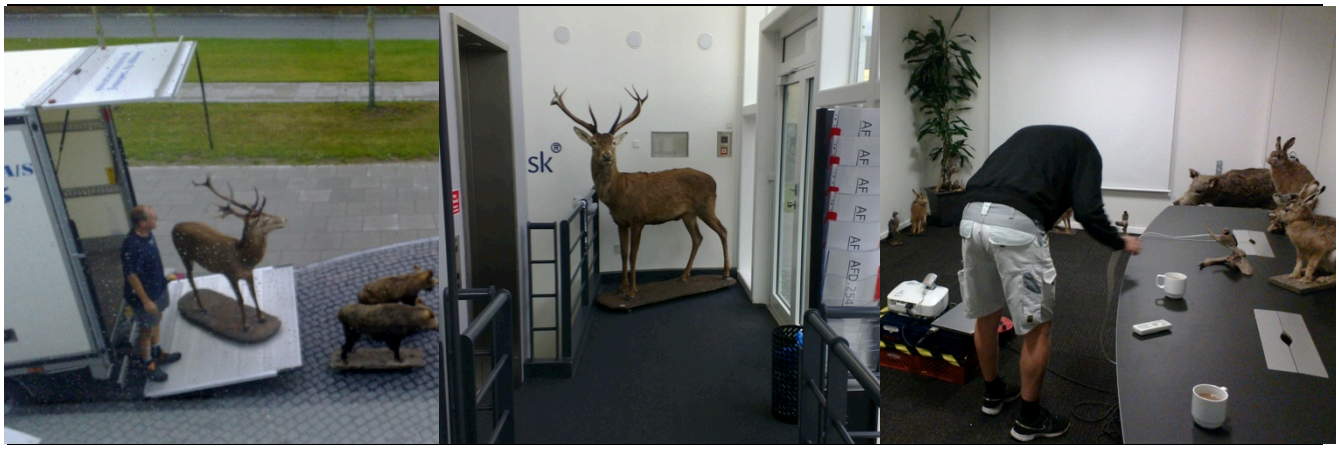


Figure 16. Improvement strategy and required improvement systems.

The research project found that effective continuous improvement requires an organizational setting around improvement activities, designated an improvement system. The higher need for continuous improvement capability the more coherent the improvement system needs to be.

The concept of the improvement system should be understood as a dynamic capability and thereby as a preparedness to initiate and organize improvement processes. The improvement system is therefore not a static entity but rather the development of a "grammar" for improvement activities. This clarifies the important role improvement leaders have in deciding to initiate an improvement activity and how they organize the improvement process. This question is discussed in the following section.



5.3 How should improvement leaders facilitate sustainable organizational performance?

The improvement system framework demonstrates that organizational settings can support improvement processes. However, the system alone does not create any improvement. The improvement system should be understood as the organization's repertoire for improvement activities, but each improvement activity will be unique and be influenced by the people who participate in leading the activity. This process of initiating and organizing improvement activities is termed improvement leadership. The research project investigated improvement leadership in a number of improvement activities to explore how the choices of improvement approach affected improvement outcomes.

The thesis's third research question was how improvement leaders should facilitate sustainable organizational performance. This question emphasized what Abernathy (1978) several decades ago labeled the productivity dilemma. Adler et al. (2009) argue organizations need to be able to both exploit and explore in order to develop sustainable organizational performance. Benner and Tushman (2003) argue that most process management approaches inevitably devolve to emphasizing exploitation over exploration and call for solutions to this challenge.

Ambidextrous Improvement Leadership

The paper "Ambidextrous Continuous Improvement: A case study of Strength-based Lean Leadership" investigates whether the choice of improvement leadership approach can solve the productivity dilemma, i.e., the ability for short and long term improvement. The paper concludes that contextual ambidexterity can be achieved through appropriate improvement leadership. The paper demonstrates how different improvement leadership approaches emphasize exploitation and exploration, respectively, and that they can be combined to achieve ambidextrous capabilities.

The research project showed how the improvement approaches problem solving and appreciative inquiry can be combined to form a repertoire of improvement steps, as illustrated in Figure 17. These improvement steps can be combined in various ways to design different improvement processes. Based on the choice of improvement steps different types of improvements can be achieved. The findings also confirm Rother's (2010) claim that the Toyota Kata is ambidextrous, as it comprises improvement steps from both problem solving and appreciative inquiry.

Consequently, improvement leaders can use the improvement step as a guideline for designing different processes depending on what type of improvement they need.

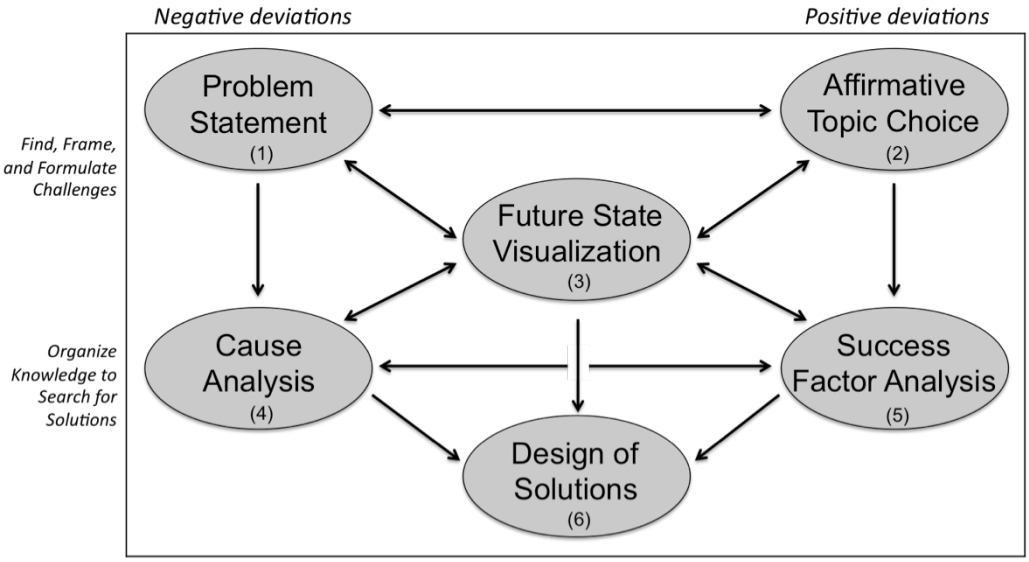


Figure 17. Improvement Step Framework.

The paper on ambidextrous continuous improvement presents a framework for understanding the different improvement types required for sustainable organizational performance, as illustrated in Figure 18. The daily adaptive learning is single loop learning, which has a limited improvement potential as it is confined to the existing s-curve. The improvement system view explains this mechanism as learning through adjustments with the same configuration of the system.

More reflective practices can lead to double loop learning. The paper divides double loop learning into two categories: Double loop exploitation and double loop exploration. Double loop exploitation is a reflective learning activity that changes the work system's governing variables, i.e., the configuration of the work system's elements. This activity changes the s-curve and opens up for a new improvement potential, as illustrated in the figure. Double loop learning is facilitated through the improvement step "cause analysis" that questions the work system's configuration.

However, the double loop exploitation will follow an improvement trajectory based on the mental models that are built up in the system, i.e., path dependence. This improvement trajectory limits the improvement potential and another improvement process is necessary to shift into a new improvement trajectory. This process is called double loop exploration. Double loop exploration not only changes the work system's governing variables, it also changes the mental models of the improvement trajectory. Thus, it challenges the existing path dependence by generative learning. The paper shows how different improvement steps can be used to design improvement activities with capabilities for each of the improvement types. Thereby, allowing improvement leaders to facilitate different types of improvements necessary for sustainable organizational performance.

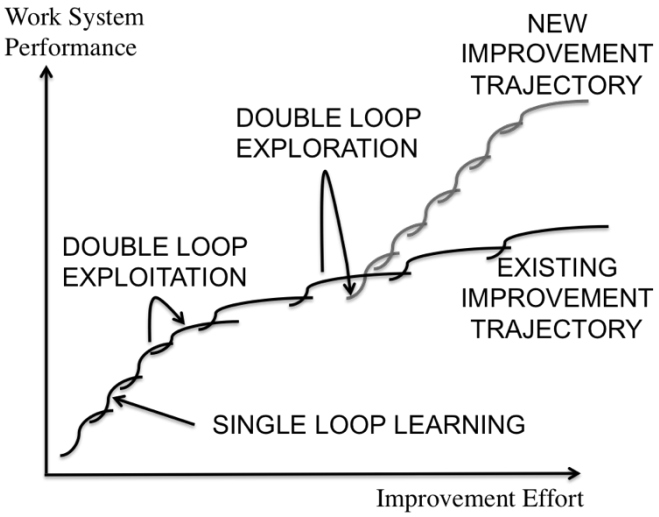


Figure 18. Improvement types necessary for sustainable organizational performance.

The research project showed how the case company supported improvement leaders in using different types of improvement approaches. As described in the paper, these findings demonstrate that contextual ambidexterity can be achieved making the problem solving and the strength-based improvement leadership approaches co-exist within the same organizational entity.

5.4 How should Organizational Transformation be Addressed?

The research project studied a case organization that managed to create a thorough organizational transformation over the time period from 2006 to 2014. This longitudinal study reveals a number of insights on how organizational transformation were addressed in this successful case. This section will discuss the fourth research question on how to address the necessary organizational transformation for achieving continuous improvement capability. First, perspectives on how to initiate organizational transformation are presented. Second, findings on how to create engaging continuous improvement are discussed, and third general perspectives on organizational transformation are discussed.

Initiating Organizational Transformation

The transformation process at the case company started with a strategic emphasis that explained the purpose of the transformation to all employees. The beginning of the transformation process in 2006 was initiated by a purpose-focused large scale activity where all employees participated and discussed how they should address the strategic challenge. The only solution seemed to be improve rapidly. This may seem like a burning platform change approach. However, the case story indicates that this was not the situation. The burning platform had been known for a year but only led to poor performance, absenteeism, and passiveness. It was not until the first occasion to move toward an attractive future state that transformation was initiated. Kongsbak (2010) describes the change approach as appreciative inquiry with a mobilization strategy. He argues that the key to the successful initiation was reframing from a problem focus to an affirmative topic focus and an engaging approach to involve everyone in the strategic project.

Another learning point from the initiation stage was that top management was engaged from the beginning and openly communicated about the strategic challenges. Management openly revealed that they did not have the solutions, but that they believed broad involvement could lead to success. This honest inviting approach lowered the barriers and enabled the otherwise critical employees to contribute instead of challenging the change process.

Engaging in Continuous Improvement

After the initiating step, continuous improvement gradually evolved over the next years. The development from what Bessant and Francis (1999) characterize as structured and systematic continuous improvement to the stage of strategic continuous improvement took five years. These five years even had non-stop top management focus, employee buy-in, and dedicated people to

champion the transformation process. This clearly shows that organizational transformation requires focus, commitment, and time for the change process to happen. The transformation process was supported by new technology such as improvement boards, data collection systems, visual performance boards, improvement tools, new routines, new work standards, and much more. The transformation addressed the entire system and was not a single-minded focus on a few methods. However, the analysis of the development period presented in Paper 2 suggests that three factors were particularly important for the organizational transformation.

First, the use of strategic metaphors. The clear strategy-driven metaphor that was introduced with the new vision in 2009 clearly made an impact. Numerous identity-creating artifacts everywhere in the facility, including a 2.5 meter tall mountain of polystyrene, made the vision evident in the daily picture. However, the *Best In Class* vision was much more than a fun brand. On almost all occasions where the managers had the opportunity they stressed the strategic importance of reaching the mountaintop as best in class for the facility to survive. The metaphor even got embedded into the daily language of team leaders and employees, who would use the terms *mountain leadership* and *best in class* or mountain metaphors such as *pulling each other up the cliff* and *aiming for the top*. The understanding of the strategy through the mountain language and symbols in the facility often acted as guiding principles and motivation during improvement work. Also, the metaphor was used actively for onboarding of new employees, who were introduced to the mountain story and in a ceremony placed a LEGO figure on the mountain to symbolize their participation in the ascent.

These examples show how the important alignment of the organization's purpose and the improvement activities can be carried out in practice, which is also stressed by Bessant and Francis (1999) and Anand et al. (2009). Furthermore, the effectiveness of using a guiding metaphor for enhancing organizational transformation is also documented in a meta-study of transformational change processes (Bushe and Kassam, 2005).

Second, an insistent use of large-scale events. The use of frequent and strategic off-sites with all employees and funny business events at the facility revealed a management focus of engaging everyone toward a desired future state as well as building shared understanding and focus. This approach could accelerate transformation by accentuating what Cooperrider and Srivastva (1987) call the constructionist principle and Cooperrider (2000) further discuss as the actionable power of the positive image. Also, it embraces the use of positive emotions to facilitate development, as Fredrickson (1998) describes with her broaden-and-build theory.

Third, a huge emphasis on leadership development was evident in the company. For example frequent leadership development activities such as monthly leadership seminars for all managers and 5 to 25 days of leadership courses per manager per year. Furthermore, extensive use of leadership and improvement coaches further stressed the emphasis on creating an environment for leadership development. Also, the practice of having all managers coaching their direct reports on the shop-floor encouraged dialogues about leadership. This practice of continuously developing leadership also showed during performance board meetings that were developed to include leadership sparring.

Furthermore, leadership development was not limited to managers in formal positions; informal leaders were also encouraged and supported to use their strengths to champion improvement efforts. These informal leaders actually created some of the more radical improvements over the time period. Some improvements even required severe lobbyism at the unions, among employees, and in the company's other departments. This change approach is similar to Kotter's (2012) idea about a dual organizational system for facilitating change where volunteers engage in parallel with their regular jobs. This leadership development approach corresponds well with the finding that

transformational leadership is positively correlated with successful quality management implementation (Hirtz et al., 2007).

Perspectives on Organizational Transformation

The longitudinal study highlights four levers of organizational transformation: Initiate with a purpose-driven affirmative approach, use strategic metaphors, engage everyone through large-scale events, and emphasize continuous leadership development to support the transformation process.

These levers are a supplement to the dedicated daily efforts of sustaining new behavior. Continuous improvement capability is not achieved as a one-off transformation, but requires a long time to gradually build. However, the research project reveals new insights that can highlight the most important aspects of developing continuous improvement capability.

Continuous improvement capability should be developed as a coherent improvement system rather than just as competence in improvement methods. The state of the improvement system can be analyzed with the provided improvement system framework in this thesis. Furthermore, the development of a second order improvement system can aid the organizational transformation toward continuous improvement capability.

6. Conclusion

This thesis aims at contributing to decoding the productivity code of the 21st century. That is, contribute to theory about how organizations can become capable of continuous improvement in an environment where everyone's minds needs to be part of the improvement game. The thesis answers four research questions:

- How should organizations address continuous improvement capability strategically?
- How should continuous improvement capability be organized?
- How should improvement leaders facilitate sustainable organizational performance?
- How should organizations transform to achieve improvement capability?

These questions were investigated longitudinally with an action research methodology over a 3-year project period. The case company was a Danish manufacturing facility for medical devices. The case company had a strategic focus on achieving continuous improvement capability and turned out to be an ideal project setting since they experimented due to their explicit experimentation with ways to develop employee-driven continuous improvement.

The research project identified an important strategic consideration: How to combine the development of realizing improvements and building improvement competences. The resulting model and sights can be used to formulate an explicit improvement strategy.

The study concludes that the researched facility developed continuous improvement capability over the time period and that it occurred through development of an organizational setting for improvement activities, termed the improvement system. The improvement system comprised five elements: An improvement process, participants, management, organization, and technology. The concept of an improvement system is not an organizational structure but rather an ability and readiness to organize adequate improvement activities for relevant challenges. The study showed how the effectiveness of the improvement system depends on the congruent fit between these five elements and the bridging coherence between the improvement system and the operational work system, which includes the activation of improvement, information flow, and implementation approach. This finding answers how continuous improvement capability should be organized: As a coherent improvement system that effectively improves the work system.

Continuous improvement requires active facilitation by improvement leaders. The research project revealed how improvement leaders approach impacted whether improvements were exploitative or explorative. Both improvement types are necessary for long-term productivity development and the ability to balance them is a key to the productivity dilemma. The study showed that the productivity dilemma is manageable through ambidextrous improvement leadership that combines problem solving with strength-based perspectives.

Organizational transformation is necessary to develop continuous improvement capability. The research project revealed four levers for organizational transformation that aided the case company in achieving continuous improvement capability: Initiation with a purpose-driven affirmative approach, use of strategic metaphors, engagement of everyone through large-scale events, and emphasis on continuous leadership development to support the transformation process. Also, the project highlights that organizational transformation is not only about changing people's mindsets or teaching them improvement methods, rather, the organizational transformation toward continuous improvement capability is about developing a coherent improvement system and developing competence in leading improvements supported by the organizational settings of the

improvement system. Also, the use of a second order improvement system may be viable for organizations that have a strategic demand for continuous improvement capability.

Towards an Improvement Theory for Sustainable Organizational Performance

The presented conclusions show that organizations' increasing need for improvement cannot be addressed simply through individual learning, organizational learning processes, new work system design, or by following any other single theory.

Instead, sustainable organizational performance requires a systemic approach and continuous improvement in structured organizational settings as well as a leadership capability for initiating the appropriate improvement to address current challenges.

The thesis shows the need for a new improvement theory that integrates the fragmented theoretical perspectives in the field into one coherent model. The findings of the research project can be used towards constructing a coherent improvement theory.

First, by introducing strategic considerations. Second, by introducing a systemic perspective that integrates the process, individual, organizational, managerial, and technological factors. And third, by introducing a leadership perspective. These contributions constitute building blocks that hopefully some day can add up a coherent improvement theory for sustainable organizational performance.

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Appendix A – Research Papers

The thesis contains three research papers that are attached in the following pages.

Table 5. Research Papers.

Paper Title	Target Journal	Status
What is your improvement strategy?	Quality Progress	Accepted
Conceptualizing Dynamic Capabilities in Lean Production: What are they and how do they develop?	Engineering Management Journal	In revision
Ambidextrous Continuous Improvement: A case study of Strength-based Lean leadership	International Journal of Operations and Production Management	Submitted

What is your improvement strategy?

David Hansen, Industrial PhD Candidate at the Technical University of Denmark

Organizations rarely think strategically about how to focus improvement efforts and which methods match their needs. Here is an invitation to find your appropriate improvement strategy and methods.

In 50 Words or Less.

- Many continuous improvement programs focus on realizing improvements through problem solving but neglect sufficient capability building.
- Often, these programs lack a clear improvement strategy, and pick inadequate methods to support the strategy.
- This paper presents a framework for designing improvement methods for increased capability building.

We want to solve problems, but should we? Continuous improvement initiatives are used everywhere and along have come improvement methods based on the scientific method such as root-cause analysis to identify and solve problems. Problem solving creates improvement.

However, the focus on problem elimination draws away attention from another aspect of continuous improvement; strengthening organizational capabilities necessary for the operations strategy. Competence building is best achieved by improvement methods that focus on reinforcing competences by learning from successful experiences and discussing preferred future states. So, should shop floor management focus on problem solving or competence building?

This paper offers a framework for deciding an improvement strategy to handle whether to focus on realizing improvements or building competences, and discusses the role of different improvement methods. The paper builds on a European multi-year case study at a manufacturing facility and presents an empirically tested framework for designing better improvement methods to match improvement strategies.

Understanding improvement

Organizations' ability to learn and improve has been a critical competence in operations and quality management for decades [1], but improvement come in different shapes, as the following story highlights:

> *"Sam was frustrated as the machine had been down for days due to a trivial problem. Finally, the defect was found and the machine was running again. But Sam was not yet satisfied. He knew this would happen again, and that the organization was incapable of coordinating improvement efforts well. He invited key stakeholders to a workshop series that eventually redesigned the daily performance meeting structure and training of team leaders. The result: Better coordination between units, faster problem solving, and better quality and efficiency."*

First, Sam eliminated a performance problem, and second, he strengthened the organization's competence to solve future problems. Thus, improvement activities can either target productivity directly or target the ability to identify improvement potential in the organization. Thus, continuous improvement programs should consider how they affect two dimensions: *Realization efficiency* and *improvement competence*. Both are important dimensions but the optimal balance depends on the organization's operations strategy.

Realization efficiency is the amount of achieved improvement per improvement potential, e.g., the available ideas for increasing quality or efficiency (as in Sam's story), shorter lead times, less scrap, a better work environment, new products, etc.

Improvement competence is defined here as the organization's ability to identify improvement potential. Improvement competence can be quantified as the number of ideas times the average potential value per idea per time unit, e.g., potential value per day. Improvement competence thus depends on the engagement of people, their ability to identify problems and opportunities, on analytical skills, and on organizational elements such as management, coordination (as in Sam's story), alignment between improvement goals and organizational direction, etc.

Deciding an improvement strategy

High levels of both realization efficiency and improvement competence is often described as dynamic capability, i.e., “a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.” [2]

An organization cannot focus all efforts on realization without losing focus on competence building and vice versa. Consequently, an explicit choice of where to focus efforts should be made. A shrinking telecom business may need expert-driven rationalization for a while to survive while a new manufacturing facility may need focus on employee empowerment to begin its improvement journey.

Consequently, every organization should actively decide on an improvement strategy balancing efforts between realization efficiency and improvement competence depending on current needs and future plans. Figure 1 shows an improvement strategy framework that can be used to assess an organization’s current state and to decide a desired future state.

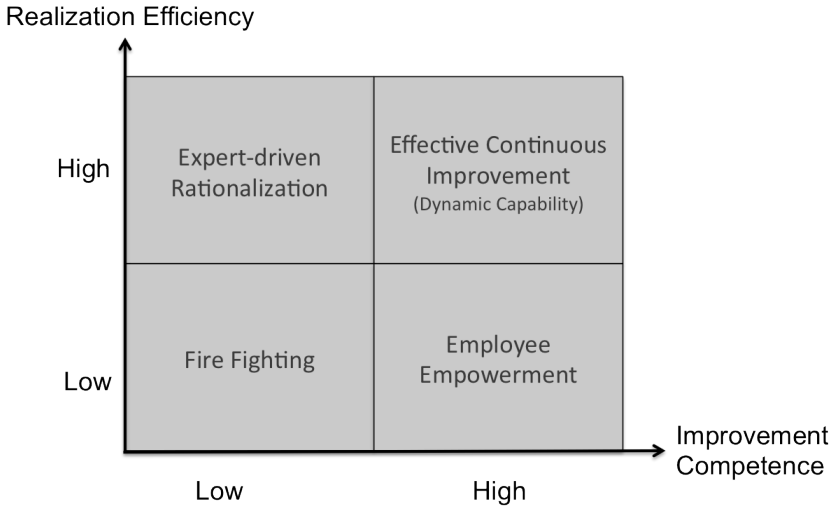

Figure 1: Improvement strategy framework

The figure show four generic strategies: *Expert-driven Rationalization* means focusing on realization over competence building, *Employee Empowerment* means building competence

with limited focus on realization, *Fire Fighting* means neither focus on realization nor on competence building, and Effective Continuous Improvement means focus on both realization efficiency and competence, i.e., dynamic capability.

Aligning the strategy and improvement methods

An organization's improvement strategy can be achieved through an improvement program that appropriately balances improvement realization and improvement competence. Researchers Anand and colleagues describe how a program should consider the three elements *purpose* (e.g., alignment of improvement goals with organizational goals), *people* (e.g., development of employee skills), and *process* (e.g., improvement methods) [3].

While most improvement programs actively consider the purpose and people elements few discuss the process element, and thus, unconsciously use problem solving based on the scientific method. However, as this paper will show, other improvement methods exist centered on learning processes, co-creation of visions, and enhancement of strengths [4]. Competence building requires reinforcement of positive experiences and repetition of desired behavior for weeks to build new neurological pathways [5], i.e., requires daily focus on positive deviations and practice. Thus, the palette of improvement methods decides how an organization develops its realization efficiency and improvement competence.

Consider an example from our study: A machine cleaning process had increased to double time. During daily performance monitoring the concern was raised and a team assigned to solve the issue. Through problem solving they quickly identified the cause of poor performance, fixed it, and efficiently realized an improvement for returning performance to standard. A subsequent interview with the team revealed increase in realization efficiency but no increase in improvement competence since they focused on fixing rather than learning.

Later, the team tried an alternative improvement method, Appreciative Inquiry, on a similar problem. Instead of analyzing causes of poor behavior they identified factors creating successful performance and through a creative process they found a novel idea of cleaning the machine during maintenance stops instead. Another interview revealed that this method

increased their improvement competence due to a broader scope and more ideas, although it did not increase their realization efficiency.

Consequently, the improvement strategy should explicitly decide the choice of improvement method, opposed to the method unconsciously dictating the strategy. The following sections will discuss how different methods balance the development of realization efficiency and improvement competence.

The power of problem solving

In continuous improvement problem solving by root cause analysis is a widely used method. Through investigating undesired events and understanding their cause the method ensures permanent solutions to problems by eliminating the problem's root [6, 7]. Specific methods include Deming's PDCA circle, Six Sigma's DMAIC method, and Lean's A3 systematic problem solving (i.e., Toyota Business Processes) [8, 9]. In this paper all these scientific methods are referred to as problem solving.

Most problem solving activities are initiated from a gap between a target condition and the measured actual condition. In general, most problem solving methods can be simplified into three steps, known as the three C's [10]: Understand the *Concern,* investigate the root *Cause,* and implement the C*ountermeasure*.

After stating the problem concern and grasping the current situation, gradually more and more information is collected in order to identify the direct cause of the problem, i.e., where the problem occurs. Then, the underlying root cause can be found by analysis, e.g., by asking why-questions such as "why did the direct cause happen?", "Why did the cause of the cause happen?", etc. Finally, a countermeasure is devised that can eliminate the root cause and ensure the problem will not reoccur.

Root cause problem solving can lead to either single or double loop learning [11] depending on how the root-cause analysis is made and the chosen countermeasure.

Figure 2 illustrates the problem solving method. The planning phase shows the concern step followed by cause analysis. During the doing phase cause-knowledge is used to identify a countermeasure to solve the problem.

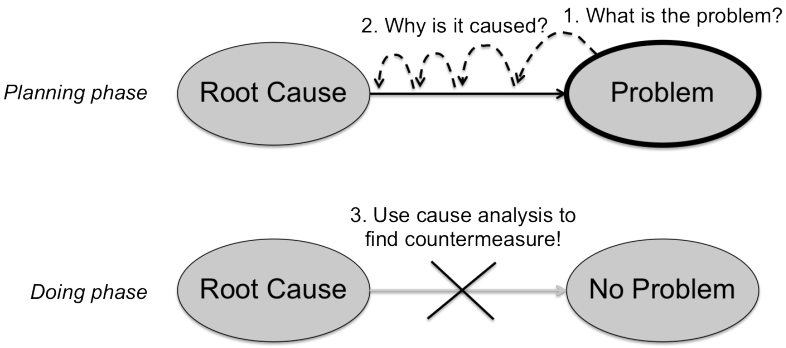

Figure 2: Root cause problem solving method.

The power of problem solving is its efficiency in finding a solution through a systematic approach that enables it to be taught and used widely in organizations [12]. However, problem solving is criticized for inhibiting learning because of limiting the problem space by constraints from the initial problem definition [13, 14], and also because root cause analysis uses reasoning based on normative causality, i.e., solutions within existing mental models that tend to focus on incremental improvements rather than architectural or systemic improvements [15, 16]. Furthermore, problem solving tend to focus on technical improvements and not sufficiently on the necessary social transformation and competence building of people and teams [17].

The advantages of appreciative inquiry

Appreciative inquiry is an improvement method developed by Cooperrider that is focused on building improvement competence. Cooperrider's research showed that social change occurred faster and more creatively when the change efforts focused on expanding existing success experiences rather than identifying problems to eliminate [18]. Based on this finding, Appreciative Inquiry was developed as method for defining preferred future states and building competence to reach them. Figure 3 describes the underlying principles of Appreciative Inquiry.

Figure 3: Appreciative Inquiry is based on five principles [19].

***Anticipatory principle*:** Actions are guided by images and expectations of the future, i.e., positive future images create positive actions.
***Constructionist principle*:** Everyone who needs to be part of the change should participate in the construction process in order to understand the new future.
***Poetic principle*:** The issues that get attention grow in peoples' minds; the change thus needs to develop and sustain a new language for the desired future state.
***Positive principle*:** Building momentum for change requires positive affect and social bonding such as hope, excitement, inspiration, and urgent purpose.
***Simultaneity principle*:** Change begins with the questions asked and analysis cannot be isolated from implementation.

The Appreciative Inquiry method can be initiated from either a problem or an opportunity through the following phases:

1) Defining an affirmative topic; a compelling and attractive question for the organization to answer where the answer initiates desired change. An affirmative topic reformulation transforms "the problem to solve is the team's low productivity and high absenteeism!" into "how do we become a high performance team where everyone uses their top strengths everyday?" The difference in engagement and opportunities for action is remarkable and shows the simultaneity principle in action; this question alone begins an improvement journey.

2) Discovery of success factors already existing in the organization for answering the affirmative topic, e.g., positive experiences, strengths, knowledge, motivations, etc. By sharing stories that illuminate success factors the poetic and positive principles are put into action.

3) Creation of a shared future dream. Here, as many participants as possible are engaged in co-creating and visualizing the preferred future state. This activates the constructionist and anticipatory principles

4) Design of solutions for realizing the future state. The solutions should be provocative in the way that they make people think and act in new ways [20]. Successful initiatives often create a guiding metaphor that continues all the way until implementation [21].

5) Implementation and turning the designs into action. Often, initiatives that create transformational change drive prioritization based on engagement and personal initiative rather than planning the change [22].

Figure 4 illustrates Appreciative Inquiry. First, the problem (or opportunity) is reframed into an affirmative topic, then success factors are identified, and a desired future state is visualized (dream). Then, the doing phase uses the success factors for designing and realizing the improvement.

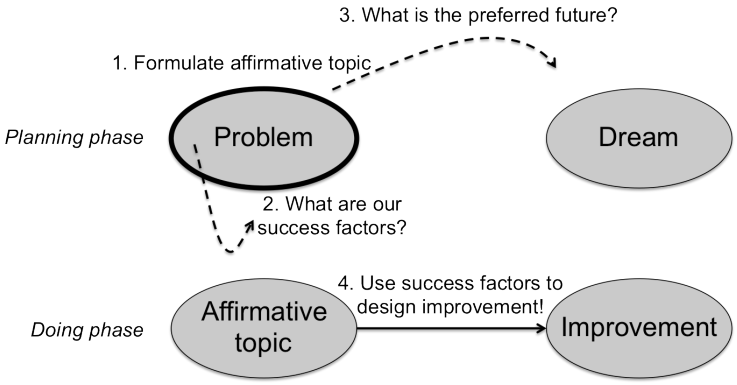

Figure 4: Appreciative Inquiry improvement method.

The illustration shows Appreciative Inquiry as future oriented creating improvement by elevating competence in the system. The method assumes that problem understanding is not necessary to create improvement; you only need to understand the desired future state. Johnston and Beck discuss the power of the positive approach applied to Lean Six Sigma and highlight how elements from positive psychology can help create empowered and a more productive work force [23]. Accordingly, Appreciative Inquiry brings competence building elements into the improvement method: In the affirmative topic step by broadening the solution space and generating new social assumptions [24, 25]; in the success factor analysis by accelerating learning through success experiences focus [26, 27], reinforcement of positive behavior [28], surfacing tacit knowledge [29], and by raising social relations and expectations [30]; and in the future state visualization step by creating shared purpose and positive future images [31].

A broader improvement method framework

As illustrated, problem solving and Appreciative Inquiry are different methods in how they initiate improvement, describe goals, and collect knowledge. Problem solving focuses on realization and Appreciative inquiry on competence building.

The two methods' steps can be used to form an improvement method framework that visualizes combination possibilities, see figure 5. The six bubbles represent improvement steps and the arrows show possible combinations. Each combination represents an alternative improvement method. As examples: Problem solving starts with Problem Statement (1) followed by Cause Analysis (3), and finishes with Design of Solutions (6). Appreciative Inquiry starts with Affirmative Choice (2), then Success Factor Analysis (4), followed by Future State Visualization (3), and finally Design of Solutions (6).

Although the two methods seem mutually exclusive, they are not. Some methods combine steps from each, e.g., The Toyota Kata [32] (steps 1, 3, 4, and 6) and the Solutions Focus method [33] (steps 1, 2, 5, and 6).

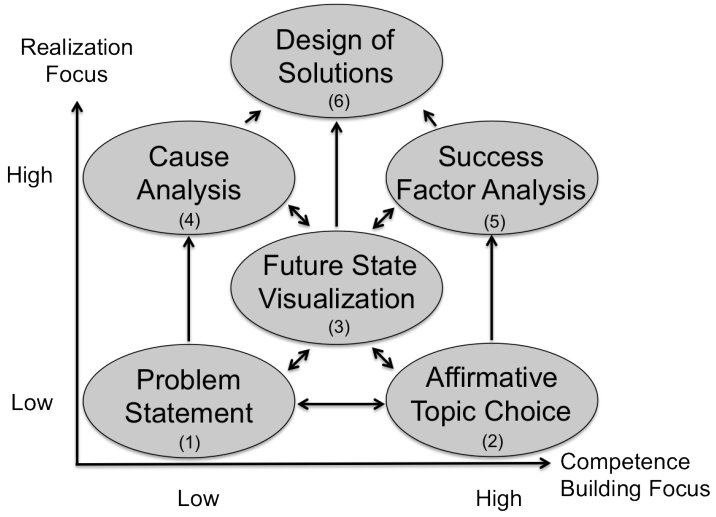

Figure 5: The Improvement Method Framework.

Adding new improvement methods to your palette

The improvement method framework can be used to design a palette of methods supporting any specific improvement strategy, as steps on the left-hand-side emphasize realization and the steps on the right-hand-side emphasize competence building. Here are three method ideas based on empirical exploration of the framework:

- **Learn from daily success.** Step 2: “How can we elevate the best of what we already do?” Step 5: Monitor daily performance and use anything exceeding the expected as an opportunity to initiate systematic success factor analysis. Step 6: Reinforce the success factors and repeat the successes in the future.
- **Put a shared perspective on problem solving:** Step 1: Define the problem and grasp the current situation. Step 3: Gather stakeholders and create a shared dream about the future. Step 4: Analyze problem causes to the root. Step 6: Identify countermeasures to eliminate problems and realize the desired future state.
- **Solve problems by competence building:** Step 1: Define the problem and grasp the current situation. Step 3. Gather stakeholders to create a shared dream. Step 5: Identify success factors for realizing the dream’s elements. Step 6: Identify initiatives that turn the success factors into solutions to the problem.

Taking the next step

Improvement efforts should address both realization efficiency and competence building. An improvement strategy should explicitly choose how to balance efforts. Because different improvement methods develop realization efficiency and competence building differently, the methods should also be actively decided. Examples in the paper show how improvement methods can be designed to support different improvement strategies and the paper presents a framework for designing methods for a particular improvement strategy. The framework also shows how elements of problem solving and appreciative inquiry can be combined for more comprehensive improvement methods for daily improvement activities.

The art of defining and operating an improvement strategy is a key competence in successful quality and operations management. What is your next step?

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Conceptualizing Dynamic Capabilities in Lean Production: What are they and how are they developed?

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Niels Møller, Technical University of Denmark

Abstract: This paper addresses the need for developing long-term learning abilities in Lean production: dynamic capabilities. Despite Lean's remarkable popularity, implementation efforts often emphasize short-term efficiency over developing dynamic capabilities necessary for long-term success. This paper advances the understanding of dynamic capabilities in Lean based on a longitudinal in-depth case study at a manufacturing facility. The paper shows that dynamic capabilities develop as the organizational setting for improvement activities, termed the improvement system. The improvement system's effectiveness is characterized by congruent coherence between participants, technology, management, and organization, and bridging coherence between the improvement system and the work system.

Keywords: Dynamic Capabilities, Lean, Work System Design, Improvement System

EMJ Focus Areas: Organization & Work System Design

Dynamic capabilities are organizational abilities to systematically and continuously develop the work (Teece et al. 1997). They are a key factor for achieving competitive advantages through creating or sustaining better resources and capabilities (Barney, 1991; Voss, 2005) or pursuing niche operations strategies such as being flexible firms part of a larger network (Johansen & Riis, 2005; Zhang, 2011). With increasing global competition, demographic changes, accelerating technological innovation and with increased demands for efficiency, productivity, and quality, most organizations acknowledge the need for learning and engaging employees in improvement activities (Delbridge et al., 1998). Lean and the Toyota Production System have spread as concepts throughout manufacturing, service, product development, and the public sector with the promise of delivering efficiency and developing capabilities for continuous improvement (Liker, 2004; Liker & Morgan, 2011; Arlbjørn et. al., 2011).

However, despite its extensive popularity in research and practice there is no consensus about how Lean should be implemented or even what it is (Brännmark et. al., 2012). The literature shows a divide between 1) Lean as a collection of tools for concrete problem solving and waste reduction (Hines et al., 2004; Pettersen, 2009), 2) Lean as a set of actionable principles (Womack & Jones, 2003), and 3) Lean as a philosophy of long-term excellence based on learning, focus on costumer value, and waste reduction (Liker, 2004; Shah & Ward, 2007). Despite the different views on Lean as a concept, one challenge is shared across the views: How to use Lean to create sustainable competitive advantage through effective continuous improvement (Kaye & Anderson, 1999; Savolainen, 1999; Lewis, 2000; Delbridge & Barton, 2002; Bateman, 2005). We argue that this requires the Lean efforts to focus on developing dynamic capabilities rather than only for sporadic or ad hoc point improvements. This view means that all improvement activities should act as opportunities for organizational learning even if the concrete problem solving attempt was less successful (see for example the study of kaizen events by Farris et al., 2008).

This study aims to develop the understanding of dynamic capabilities in a Lean production system. Based on a longitudinal study at a manufacturing facility with a strategic focus on developing dynamic capabilities, this paper answers the question: What are dynamic capabilities in Lean production and how do they develop?

We argue that dynamic capabilities should be seen as organizational settings for improvement activities. Furthermore, we show how the development of dynamic capabilities requires a systems focus aiming at creating congruent fit between the system's elements rather than just introducing new tools.

The paper begins with a review of dynamic capabilities followed by the study design, data collection, and empirical findings. Then, the empirical data is analyzed and discussed. Finally, recommendations for practice are given.

Are Dynamic Capabilities the Key to Long-term Lean Success?

The resource based view on strategy concludes that organizations with superior capabilities, such as valuable, rare, inimitable, and non-substitutable resources, can achieve sustainable competitive advantage based on lower costs or superior product quality (Barney, 1991; Teece et al. 1997). Winter (2003) defines a capability as "a high-level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type." Thus, capabilities translate to the organizational ability to operate efficiently.

It is necessary to change or develop new capabilities in order to achieve or sustain competitive advantage in an ever-changing environment. This can be done either through ad hoc problem solving or by continuously and systematically

developing capabilities, which is termed dynamic capabilities (Winter, 2003). Teece et al. (1997) define this ability to cope with change as dynamic capabilities, and explain them as: "a firm's ability to integrate, build, and reconfigure internal and external competences."

Research has been concerned with understanding dynamic capabilities for years (Teece et al. 1997; Eisenhardt & Martin, 2000; Zollo & Winter, 2002; Winter, 2003; Katkalo et al., 2010). The research with the dynamic capabilities view has explained how companies that possess dynamic capabilities achieve long-term competitive advantage. However, the understanding of what dynamic capabilities are at the operational level is an ongoing discussion (Katkalo et al., 2010). One view is that dynamic capabilities are specific and identifiable processes (Eisenhardt & Martin, 2000) and another view divides them into two types: operational improvements and strategically and long-termed (Zollo & Winter, 2002). A deeper understanding of what dynamic capabilities are and how they develop can be the key to achieving long-term success.

Zollo and Winter (2002) offer a definition of dynamic capabilities that can help with a further understanding of their nature: "a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness." This dynamic capabilities definition comprises two main components: a stable pattern and collective activity. The definition connects dynamic capabilities to the concept of continuous improvement since collective activity can be seen as a problem solving activity in continuous improvement and a learned and stable pattern can be seen as the context for the problem solving activities. Bessant and Francis (1999) also argue that continuous improvement capabilities are a form of dynamic capabilities and offer insights into the qualitative criteria that determine continuous improvement maturity. Anand et al. (2009) further reinforce the relation between dynamic capabilities and continuous improvement by studying how continuous improvement infrastructure can act as an organizational context for dynamic capabilities. Thus, continuous improvement can be an approach to dynamic capabilities if it involves a learned and stable pattern as context for the improvement activities. This view corresponds well with the problem-finding and problem-solving perspective for achieving dynamic capabilities (Nickerson et al., 2012).

The literature argues that continuous improvement can be an approach for developing dynamic capabilities, but the literature does not conceptualize how to do this at the operational level. Neither does the literature describe how to develop dynamic capabilities over time. For example, the study by Anand et al. (2009) showed how continuous improvement infrastructure aided the development of dynamic capabilities by comparing five case companies through phone interviews. Their study yielded a great high-level overview, but the method limited their findings to an overview without detailed operational insights. Also, their method captures one slice in time and therefore did not address development of dynamic capabilities.

This paper aims at contributing to this gap in the literature by investigating dynamic capabilities in-depth at the operational level and their development over time. This aim implies a series of challenges for the research method.

Method

Liker and Morgan (2006) highlight a number of challenges for practicing and researching Lean, which include understanding systems perspective and how learning cultures evolve. The challenges are further discussed in Liker and Morgan (2011), who present three main challenges to address in Lean research:

1. *Lean is an emergent system:* In order to be highly effective Lean requires integration of people, processes, and tools, which means that hypotheses of individual best practices cannot be tested since a systems view assumes complex interactions between variables. A reductionist view of isolated elements of the system will lead to misleading conclusions.
2. *Lean is a dynamic evolving process:* Measurement at one slice in time only represents a stop in the journey, thus research needs to be longitudinal.
3. *Lean is an evolving culture:* Lean should not be judged only on the structure of work processes since the culture is an essential feature of the system, and thus, people's way of thinking should also be captured.

They suggest future research to be based on in-depth cases studied over time with action research and non-deterministic research questions while looking for cultural shifts, e.g. in language or focus (Liker & Morgan, 2011).

Study Design

Since the research question aims at describing a concept in-depth and due to the posed methodological challenges, an inductive research approach was chosen. Inspiration was found in grounded theory, which describes how to build theory from data when existing theory cannot explain the subject (Glaser & Strauss, 1967). However, grounded theory emphasizes the participants' social construction of meaning based on thoughts and words, whereas the study of an engineering setting also needs to understand the technical system and the physical effects independent of what people "think about them". Thus, the study design needs to integrate different data collection methods for capturing both language and the non-spoken such as analyzing objects (e.g., Carlile, 2002). Inspiration can also be found in action research (Argyris, 1983; Greenwood & Levin, 2011). Since the research question is concerned with investigating a development progress, the action research strategy possesses an advantage in its ability to help facilitate this development through active engagement by the researcher. Through dialogues, the reflective ability of the participating company can be raised thereby making the development progress more explicit for the researcher to investigate.

The study was then designed with active researcher participation based on dialogues and with research data

collected and analyzed inductively. The study also needed to be holistically and systems focused, longitudinal, and in-depth. This made a longitudinal action research project with wide access to in-depth investigations the preferred option.

The study design was also inspired by the reflective case study approach (Kotnour & Landeata, 2004), but instead of investigating learning from a single case of an engineering management improvement approach (see for example Brown et al., 2006; Farris et al., 2008; Liker & Morgan, 2011), this study was designed to investigate the evolving development of the facility based on multiple cases of improvement. That is, the data collection was carried out as a single case study with a collection of embedded sub-cases. In this way, the study design became longitudinal, in-depth, and as a result it was possible to incorporate with a holistic and systems focused view. The following research design was used:

1. Identification of a company for in-depth longitudinal study of the development of dynamic capabilities
2. Engagement with company and investigation of context, past experiences (going 4 years back), and current situation
3. Longitudinal reflective case-studies within the company and data collection for 3 years, herein iteratively doing a-d:
    a. Identification of a case for in-depth study based on sampling criteria
    b. Investigation of case and collection of qualitative data through multiple collection methods
    c. In some cases, active participation in the development activities
    d. Discussion of implications with company management to foster further reflection
4. Analysis of the collected case data
5. Discussion of the findings and consolidation of conclusions through testing in other companies.

Case Company

Based on the research design requirements the researchers searched for a longitudinal action research project with wide access to in-depth investigations. In the researchers' network an appropriate case company was identified, and in 2010 a research project was initiated. The company was a Danish medical devices manufacturing facility working with Lean manufacturing. The facility had realized that a strategic focus on becoming a ramp-up specialist was their only way to survive as a manufacturer in a high wage country. Consequently, the facility's management had focused on establishing dynamic capabilities based on Lean for four years already. The time period of the research project was characterized by lots of changes at the facility, managers who encouraged active development of thinking ways and were open for changing their organization. The company thus turned out to be an ideal case study of developing dynamic capabilities.

The case company is part of a larger enterprise and at the corporate level several initiatives for efficiency, leadership development, etc., are often pushed out to the local facilities. Also, the enterprise is in the pharmaceutical industry, which implies heavy focus on quality, compliance to standards, and constant readiness for the American Food and Drug Administration (FDA) audits.

Dialogical Action Research Approach

The research project was established through a program co-funded by the Danish government called the Industrial PhD Program, which allows a researcher to be employed at a company and at a university simultaneously. In this case the Industrial PhD student was co-funded by both a consulting firm and the case company. This resulted in wide access within the case company as well as ensuring their buy-in for participation. The research project was scoped with the manager of the facility as an action research project for understanding how to develop dynamic capabilities.

In order to facilitate the development of dynamic capabilities, the research approach was inspired by Maurer and Githens (2010) call for dialogical action research. Whereas the origins of action research are synonymized with Lewin's (1947) famous 'un-freeze, transition, re-freeze' model the dialogical action research approach seeks to move beyond linear problem solving that overemphasizes change as a short-term intervention brought about intentionally (as criticized by Weick & Quinn, 1999). The dialogical approach implies that the researchers facilitate learning through discussions that catalyze reflective practices and double loop learning (Argyris, 1983). The research approach was also inspired by appreciative inquiry and emphasized making life-giving and successful practices explicit in order to reinforce desired behavior and to facilitate the development of new social realities (Cooperrider & Srivastva, 1987; Cooperrider et. al, 2008).

An implication of action research is the use of participatory data collection methods. These methods give access to otherwise inaccessible information by allowing researchers to explicitly look for issues and by influencing the respondents to better understand what to look for and how to think about issues. However, participatory methods also limit the quality of the data due to the bias of the researchers and the key informants (Kawulich, 2005). In this case the company and researchers were biased towards finding something that resembled dynamic capabilities, even if they were not present.

Case Sampling and Data Collection

First step of the data collection was aimed at investigating the context, past experiences, and current situation. This was carried out through interviews, shop-floor observations, and a quantitative survey of the work environment and social capital (Kristensen et. al., 2005).

The following data collection aimed at investigating how dynamic capabilities were developed. For a period of three years a researcher was present in the facility to identify and study cases that addressed development of dynamic capabilities. Thus, looking for cases that (following the

definition by Zollo & Winter, 2002) developed the organization's stable pattern of collective activity that modifies operating routines for improved effectiveness.

In order to identify development of new dynamic capabilities, the research needed to consider the pattern before, how the pattern changed, and the pattern afterwards. Based on these requirements a case was defined as a description of a stable pattern of collective activity for improving operational routines, an intervention changing the pattern, and a new pattern after the intervention.

A sample of cases was then studied in-depth to investigate how dynamic capabilities were developed to understand the work system's evolving development. Sampling criteria for in-depth investigation were cases that described a change in the pattern of collective activity for modifying operating routines identified by either a) observations of a new pattern, b) changes in language about a pattern of activities, or c) explicit evaluation or reflection about a new pattern. Thus, case identification either happened before a change, during a change, or afterwards when it had become evident that the pattern of collective activity had changed.

All cases that met the sampling criteria were investigated in-depth. Some cases were several years old whilst others were current. An overview of the investigated cases is presented in Exhibit 1 with a short description and a case title.

Exhibit 1. Cases investigated in-depth.

Time	Case (*Short title*) and description
2006	**Engagement turn around (*Most Wanted*):** The facility had very low productivity, engagement, and virtually no improvement activities. A bold turn-around initiative based on large-scale involvement changed the engagement completely and introduced team based ad hoc improvement sessions leading to radical performance increases. (Case description published by Kongsbak, 2010.)
2007	**Idea Management System (*Kaizen*):** Improvement efforts got supported through an idea management system with prizes and support for idea implementation.
2008	**Lean Systems:** Lean systems such as performance board governance, systematic problem solving tools were introduced and became the basis for improvement activities.
2008	**Monthly Manager Off-site (*The Leadership Break*):** Recurring space for leadership discussions and development activities for all managers at all levels (≈30 people). Also, a strong emphasis on external leadership courses for all managers was introduced.
2009	**Lean coaching:** Use of internal and external Lean coaches at the shop-floor for both concrete problem solving and for spreading improvement thinking.
2009	**Big Why & Strategy (*Best in Class*):** Everyone in the facility were introduced to a new strategy based on a metaphor of climbing a mountain. All departments spent time describing their role in climbing the top, which led to clearer roles and responsibility for improvement efforts across the facility.
2009	**Engaging Happenings (*Funny Business*):** Surprising and amusing happenings at the shop floor for enabling creative thinking and employee buy-in through integrating fun and business discussions.
2010	**Training Within Industry (*TWI*):** Introduction of concept for operational and flexible work standards with built-in system for continuous improvement through devoted operator involvement.
2011	**Role cards introduced:** A simple and effective system for dividing work responsibilities was introduced with a degree of resistance from the employees. The implementation process led to radical discussions about efficient organization and enabled new forms of continuous improvement activities subsequently.
2011	**Strategic problem solving system (*PS@Shopfloor*):** Large-scale intervention addressing the entire problem solving system and daily management schedule, practices, and concerns. All managers were coached twice weekly for 3 months and to ensure successful change of habits.
2011	**Systematic success analysis (*3C+*):** The factory started experimenting with a systematic method for analyzing and reinforcing successful behavior and positive deviances as analogous to problem solving.
2012	**Daily improvement coordination (*Go-C meetings*):** The improvement efforts across different departments became coordinated through a daily meeting with seven different departments.
2012	**Mature TWI System:** The training within industry system was further matured and became a role-model example of a training system for the pharmaceutical devices industry. The system facilitated integration between standard work, continuous improvement efforts, people development, and management behavior.
2012	**Large-scale involvement events (*Summits*):** Based on the assumption that broad involvement of people can enable better solutions than a few experts can, and that broad involvement energizes people to further engage in improvement activities, systematic use of large-scale involvement events was initiated. For example, when thinking ways or values needed reinforcement, they gathered large groups for discussion and action. Also, when a strategy change was necessary in 2012 due to an FDA event the entire production department attended a summit day to find new solutions for competitiveness, which led to a successful insourcing of a former product.
2012	**Monthly review of improvement system (*DMS Production System*):** The management team of the production department started using one day per month for reviewing and adjusting the improvement activities, as well as larger improvements of the work system.
2013	**Strategy for Dynamic Capabilities (*BiC Expedition*):** Strategic planning process with all managers over 3 months leading to a large scale summit with all employees focused on integrating a new strategy metaphor into the daily operations. Also, frequent activities aimed at continuously developing the improvement activities were integrated into the management routines.

To illustrate how the cases were investigated, the progress of researching the *Go-C meetings* case is described briefly:

An internal consultant had coached two team leaders in different departments the same week. While coaching in the production department the coach noticed a technician working for several days on a severe problem at a business critical machine, who gave up and then the support department took over the problem solving. While coaching in the production support department the coach was

surprised that no leaders knew about the problem although it was the most critical machine at the moment. The coach raised the concern at an internal coach meeting, where the participating researcher noticed the issue and decided to investigate the case in-depth.

The initial pattern: Employees in the production did engage actively in problem solving activities but the activities were not coordinated across departments. **The change effort:** The coach used his insights to initiate a conversation between the responsible department managers about how they coordinated problem solving activities across departments. This initiated a series of workshops with key stakeholders that eventually redesigned the daily meeting structure. Due to an internal coach's observations workshops were initiated where key stakeholders redesigned the problem solving system. **The new pattern:** A new daily coordination meeting was introduced called the Go C meeting, where representatives from seven organizational entities met every morning to coordinate and prioritize problem solving activities based on customer demand. The result was more developed dynamic capabilities due to improved decision making of what problems to prioritize, better coordination between departments' improvement efforts, faster problem solving, and a visual overview of all problem solving activities that meant better follow up and sharing of learning.

This case was identified for research already in its initial phases. Data collection was carried out with multiple methods including interviews of the coach and department managers, direct observations, participation during the workshops, and object analysis of the old and new visual problem solving boards. Data was collected in a field notebook and pictures of the objects were taken.

This example shows how a case was identified in an early stage, which allowed the researcher to get an in-depth understanding by following the process closely. In other cases the researcher did not identify the case until after the change activities had begun. The example also shows how different data collection methods were useful for capturing in-depth knowledge, which was necessary for understanding the development. The collected data was continuously processed into memos, which were used for dialogues with the managers and thereby further data collection. Exhibit 2 summarizes the different data collection methods used for the case studies.

Exhibit 2. Data collection methods.

Method	Example
Interviews and dialogues	• Retrospective interviews. Key informants: Production manager, change consultant, former team leaders, experienced employees. • Semi-structured interviews and dialogues. Key informants: Production and production support team leaders and managers, Lean consultants, HR partner, and corporate vice president (head of factory).
Direct observation	• Performance board meetings • Management team meetings • Problem solving sessions and coaching sessions • Process confirmation and shop-floor management activities • Large events (e.g. funny business and summits)
Participant observation	• Training workshops • Continuous Improvement workshops • Meetings in the continuous improvement program team • Discussion workshops
Reflection sessions	• With Vice President, managers, team leaders, Lean consultants, HR partner, etc.
Document and object analyses	• Balanced scorecards and Key Performance Indicators • Performance boards • Problem solving tools and manuals • Internal Lean maturity model • Cultural artifacts such as the Best in Class mountain and strategy visualizations

Analysis

First step of the analysis was to explore whether the facility developed dynamic capabilities over the time period. Second step was to investigate what the developed dynamic capabilities comprised in order to understand them in-depth.

Three approaches were used to explore the development of dynamic capabilities. First, performance data were monitored to check whether quality and efficiency continuously increased over the time period. Second, since the manager responsible for the corporate production function continuously had to assess whether the facility was competitive for ramp-up, her internal assessment of the facility's dynamic capabilities was used as another check. Third, the improvement activities described in the cases were analyzed through a maturity model to see if they showed development. Thus, the maturity model was used as a sensitizing concept to understand maturity of improvements.

Improvement Maturity as Sensitizing Concept

Bessant and Francis (1999) argue that an organization's continuous improvement capabilities mature as an evolving process that requires accumulation and integration of new behaviors over time. They presented a maturity model for continuous improvement capabilities that was used in this paper as a sensitizing concept to investigate whether the cases developed continuous improvement capabilities. Bessant and Francis (1999) argue that the maturing of continuous improvement behavior leads to maturing performance impact, from local to organizational level, and from operational to strategic. Their maturity model is based on empirical studies and has six levels: 0) No continuous improvement (CI) activity, 1) Trying out ideas, 2) structured and systematic CI, 3) strategic CI, 4) autonomous innovation, and 5) the learning organization.

The cases were then analyzed using the maturity model to investigate whether development of continuous improvement capabilities was evident. Based on this analysis the cases were ordered into five time periods that corresponded to the first five levels of the maturity model:

Level 0: Fire Fighting. In 2005 the facility experienced crisis with low productivity, low employee satisfaction and

high absenteeism. The facility was to close within a year or two as its product was outsourced. The work system was inefficient, with old routines. Improvement efforts only happened as ad hoc fire fighting.

Level 1: Idea culture. In 2006 a dramatic turn around was carried out to attract a new product and to ensure the survival of the facility. *The Most Wanted* case introduced a large-scale change process that engaged all employees in proposing and executing improvement ideas and monthly "do-it-now" improvement sessions. Also, the Kaizen system case introduced a technology and management support for trying out new ideas. The work system was efficient and improvement happened on a regular basis based on trying out new ideas.

Level 2: Structured ramp up. In 2008 top management decided to award the facility for its successful turn-around and apparent improvement capabilities with a new product for ramp up. The *Lean systems* case introduced systems and tools with support from a corporate operations office that became the basis for improvement activities. The systems and tools included kanban, systematic problem solving methods, PDCA thinking, and performance boards for governance. The work system continuously improved its efficiency through structured and systematic improvement activities.

Over the following years the facility's improvement capabilities matured with a number of initiatives that can be seen as precursors for developing into the maturity level 3. The *Leadership Break* case showed how systematic leadership development was strongly emphasized. *The Lean Coaching* case showed how training of improvement thinking was moved onto the gemba (shop-floor) to enhance daily improvement activities building towards an effective in-line system. The *Best in Class* case showed how the facility enhanced its strategic focus on improvements through a new strategy with broad engagement and ambitious improvement activities. The strategic focus was emphasized through a massive focus on a visual identify inside the facility including an 8 foot tall mountain monument, which was used for ceremonies for all new employees. The *Funny Business* case showed how a management focus on engaging the work force through surprising events led to broader buy in and "an investment in social capital that could be exchanged for efficiency later", as a manager described. The *TWI* and *Role cards* cases showed how a training system with more flexible work standards and training standards enabled faster and more effective improvement activities in the daily operations.

Overall, these precursors show a holistic view on development of improvement activities as they addressed topics as different as leadership behavior, technological tools, employee engagement, strategy formulation and visualization, operational standards, etc.

Level 3: Strategic problem solving. In 2011 the facility engaged in an intense change process organized by the corporate operations office, the *Shopfloor Leadership* case. The problem solving system was upgraded to a stronger emphasis on strategic improvements, i.e., focusing on performance improvements based on customer demand and strategic performance targets. All managers from team leaders of the production and production support to the head of the facility were coached 8 hours weekly for 3 months by internal and external coaches. Also, formal management routines were introduced that required all managers to spend more time on the shop-floor for problem solving and process confirmation activities. During the case period the managers' language changed, and they started to use explicit terms for in-depth problem solving that showed a shift in focus from quick fixes and fire fighting to problem solving through thorough understanding. Terms such as "root cause", "temporary containment", "countermeasure", and "process confirmation" entered their vocabulary. The terms were introduced and reinforced through workshops, coaching, and also strongly through a collection of objects introduced in the case such as magnetic board stickers, problem solving templates, and an internal maturity model used in the change process for continuously assessing the performance of managers. The language sustained for at least the remaining two years of the research project, which indicates lasting cultural change.

The *Shopfloor Leadership* case and the precursors described in level 2, led to new collective patterns of improvement activities corresponding to maturity level 3, strategic improvements.

Level 4: Dynamic system. Following the strategic problem solving level, several new cases further matured the continuous improvement capabilities. The *3C+* case demonstrated how learning was expanded to also address positive deviances systematically, i.e., widening the scope for improvements. The *Summits* case showed how systematic broad involvement of all employees in key issues led to more engaged and flexible employees. The broad involvement also allowed discontinuous innovation to develop such as the successful insourcing of a former product when a strategy change forced the facility to find new ideas. Also, the broad involvement led to a radically different employee-designed manning plan that both saved dramatically on necessary manning expenses and increased satisfaction. The *Go-C Meetings* case showed how better coordination of improvement activities across departments led to enhanced prioritization of efforts, synergies, and faster sharing of learning, i.e., a continuous acceleration of the dynamic capabilities.

The *Go-C-Meeting* case describes a second order improvement activity, i.e., the precursor of second order dynamic capabilities. That is, the case describes how the stakeholders explicitly discussed and adjusted the (first order) improvement capabilities. The *DMS Production System* case showed this trend of continuous development of the improvement capabilities even clearer as it described a new setting of monthly workshops for reviewing and adjusting the effectiveness of the improvement activities. One example of a second order improvement activity was the development of a manager partner up concept where two team leaders partnered their responsibilities up and created role cards to help each other take turns in focusing on shop-

floor improvements and back office activities.

The effectiveness of the dynamic capabilities are highlighted in the *insourcing* case. The overall equipment efficiency of the production equipment was 78 % when it was insourced in 2012. Over the next year the work system was improved through improvement activities, and in 2013 the overall equipment efficiency was raised to 92 %.

The *BIC Expedition* case exemplified a movement toward maturity level 5, the learning organization, based on its focus on actively engaging everyone in improvement activities, and also explicitly through discussing how to deploy the facility's competence base to its competitive advantage (as described by Bessant & Francis, 1999).

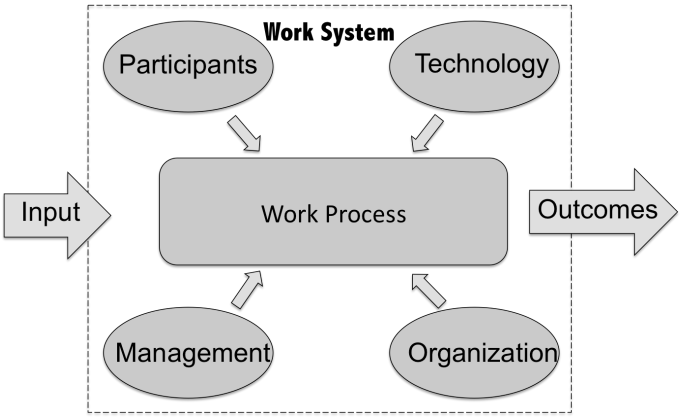
The data from the analysis of the cases indicate that the facility does develop dynamic capabilities as the improvement capabilities mature. The review of the continuous performance data improvement added further evidence to this claim since the work system was continuously improved, which was clearly seen in the insourcing case. Furthermore, the company's internal assessment of the facility's ability to deliver new product ramp-up also confirms that dynamic capabilities were achieved, which the new strategy deployment in the *BiC Expedition* case supports.

Consequently, the facility's development of improvement activities is a valid longitudinal study for getting an in-depth understanding of what dynamic capabilities are and how they function. The analysis of the cases showed that quite different elements of the work system were addressed, and also that quite different change processes were used. This realization inspired the researchers to investigate the role of the organizational setting further. As the study was set out to determine what dynamic capabilities were at the operational level, and since they were defined as collective patterns, it made sense to pursue the research question with a further analysis with emphasis on the cases' organizational settings through another sensitizing concept.

Work System Lens as Sensitizing Concept

In order to analyze the role of the organizational settings in the cases a sensitizing concept was introduced, a work system lens. A work system is defined here as an operational organizational entity that transforms inputs into outcomes through a work process. Inspired by open systems theory (Nadler & Tushman, 1980) and organizational ergonomics (through the work of Smith & Sainfort, 1989; Carayon & Smith, 2000; Kleiner, 2006; and Edwards & Jensen, 2014) we define a work system framework, shown in Exhibit 3.

Exhibit 3. Work system framework



The work system in action transforms inputs into outcomes (outputs and side-effects) through its work process based on how the four other elements interact. *Participants* refers to the human resources who participate in the transformation process with their action and knowledge. *Technology* means the artifacts, workspace, and methods (such as procedures and mental models) that are used. *Management* means the coordination activities, actions, and explicit expectations from formal and informal leaders that influence the transformation process such as goals, incentives, language, and meaningful interpretations (Weick & Quinn, 1999). *Organization* means the formal and informal structures, rules, culture, and relational aspects that influence the transformation process in action, such as hierarchy, levels of trust, norms of behavior, and relational coordination (Gittell, 2000). The formal work process can be defined as a designed sequence of tasks aimed at value-added transformations of inputs – material and information – to achieve intended outputs (Upton, 1996). The actual work process is the actual activities performed, formal as well as tacit that use the interactions between the four other entities to transform inputs into outcomes, i.e., the operating routines (as viewed by the French-speaking ergonomics tradition, e.g., Danillou, 2005).

The work system lens emphasizes the interactions between the elements in the work process such as how participants use technology to perform work tasks, how they coordinate activities based on their organization, or how work decisions are shaped by leadership behavior.

Based on this framework, the cases were reviewed to investigate the role of the organizational settings. First, all the cases were analyzed for what their improvements addressed in the work system framework. When the cases matured the improvement broadened up from addressing only one element to addressing several elements. The initial cases addressed one or two elements, whereas the later cases addressed three to five of the elements. Thus, with mature improvement capabilities came a systems focused view on improvement efforts.

Second, the cases were analyzed for how the improvement activities were organized based on the work

system framework. During this analysis it became clear that the improvement activities and the work transformation activities were organized in two independent ways. That is, the work process and the elements in the work system framework were not the same as the improvement process and its comprising elements. Thus, the work system could be improved without any maturing of the improvement system and vice versa. This realization led to the conceptualization of a similar system comprising the improvement process and its participants, technology, management, and organization, i.e., an improvement system. This conceptualization made it clear that continuous improvement maturity not only depends on good improvement processes, but also on how effective the system around the improvement process fits together. Consequently, dynamic capabilities should not just be viewed as routines or collective activities but as the surrounding patterns and organizational settings that compose an improvement system.

Further analysis of the cases with this realization in mind showed how the dynamic capabilities, i.e., the improvement system, matured over the time period. In the beginning, during the idea culture level, the improvement system only consisted of competent employees supported by management actions, but no technology or organizational design supported the improvement process.

Later, during the structured ramp up level, the improvement system became more coherent with supporting technology such as improvement boards and problem solving methods and an organizational design that supported the improvement activities.

The improvement system in the strategic problem solving level was further developed with standardized management behavior, well-connected technology for identifying problems and monitoring the improvement process, appropriate training of people, and an effective organizational set-up for improvements. Also, systematic activities were carried out by managers and specialists to continuously improve the improvement system.

In the dynamic system level, all of the elements were developed even more as a holistic system. Furthermore, the analysis suggested the emergence of another system for second order improvement, i.e., a second order improvement system with a structured improvement process, supporting technology, training of participants, management behavior, and an organizational set-up. This second order improvement system corresponds to Winter's (2003) notion of second order dynamic capabilities.

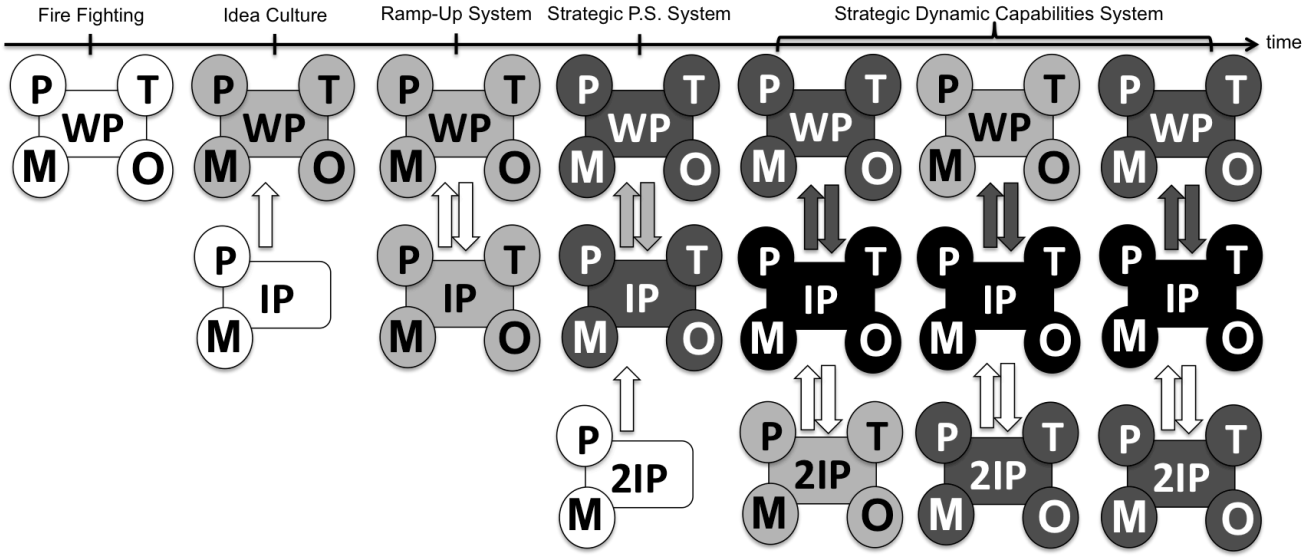
The improvement system establishes a concept for understanding the organizational setting around improvement activities. Thus, the improvement system is not a separate organizational structure and the development of the first and second order improvement systems were not a structural development. Rather, they were development of a reflective systems understanding and consequently, a broader action and thought repertoire for carrying out improvements. The improvement systems were qualitatively different from the work system by consisting of conscious human reflectivity in action (as discussed by Katkalo et al. 2010).

Development of Dynamic Capabilities in Improvement systems

The analysis showed that the company developed dynamic capabilities over the time period and that this happened through developing the organizational setting around continuous improvement activities. Before 2006 improvements happened through fire fighting with no appropriate organizational setting and gradually over time the organizational setting developed into a strategic and coherent improvement system with dynamic capabilities in 2013. Consequently, the development of dynamic capabilities is not just enhanced competence in improvement activities but the development of a coherent improvement system. Coherent both in terms of connection between the operational work system and the improvement system and in terms of fit between the elements of the improvement system. The conclusion that dynamic capabilities are related to organizational settings is in line with the findings of Anand et al. (2009) who highlight the role of continuous improvement infrastructure.

Based on the finding that dynamic capabilities matured over time through the conceptualization of an organizational setting for improvements an overview of the development is presented in Exhibit 4. The exhibit shows a timeline of the development of the improvement system divided into the phases described in the first step of the analysis. The exhibit shows the maturity of the systems: the darker the color the more mature. The top line shows the work system, second line shows how an improvement system is gradually developing, and in the bottom how the second order improvement system is formed. The Strategic Dynamic Capabilities System phase is divided into three time periods. The first shows a level 4 improvement system with a mature work system. The second shows an old product insourced back to the facility in 2012, and with it an ineffective work system with an overall equipment efficiency of 78 %. Because of the dynamic capabilities in the mature improvement system, the old work system quickly improved. The third time period shows that in 2013 the work system was improved to a much higher efficiency of 92 %. This shows that dynamic capabilities are embedded in an improvement system and are not characteristics of the operational work system.

Exhibit 4. The development of the work system, improvement system, and 2nd order improvement system over time.
The darker the color of the system, the more mature. On top the work system in the middle the improvement system, and in the bottom the second order improvement system. The arrows denote the maturity of the connections between the systems.



Implications for practitioners

The paper shows how dynamic capabilities were achieved through development of organizational settings around the improvement activities, that is, a coherent improvement system. This implication of this finding is that practitioners and researchers of continuous improvement should adjust their approach to implementing Lean and to developing dynamic capabilities. Where Lean implementation often has been focused on designing an efficient work system and then training people in problem solving methods, the findings of this paper suggests that implementation instead should focus explicitly on designing a coherent improvement system. That is, not only developing elements but also developing the connections between elements.

The term coherent system refers to how the elements within the system have congruent fit (Nadler & Tushman, 1980), i.e., between improvement process, technology, management, organizational set-up, and participants. Coherent system also means how well the improvement system is bridged with the work system. Bridging coherence relates to inputs, i.e., the activation of the improvement system and its information, and relates to outcomes, i.e., how improvements are integrated into the work system.

In order to highlight the implications for practitioners, the two coherence types are analyzed in the next sections.

Bridging Coherence between the systems

Further analysis was carried out in order to highlight the content of bridging coherence, since the concept can be hard to grasp. For example, when an improvement system is very well bridged with the work system, the two systems can be indistinguishable. During level 4, people did small experiments during their work, which is an activation of the improvement system. If the new way proved to be more effective than the old, they integrated the improvement into the work standards. In cases like this, the improvement system is almost invisible, since the improvement activities seemed just a part of the job. The analysis of the improvement system identified five factors that indicated the degree of bridging coherence between the systems.

First, *activation of the improvement system*: How the improvement processes were initiated. Activation either happens reactively through identification of positive or negative positive deviances in the work system or proactively by settings new targets in the improvement system (described as problem finding, framing and formulating by Nickerson et al., 2012). With increasing maturity a shift was identified from activation based on a problem-driven view to a value-driven view, which meant a more reflective approach based on customer value and not just a perceived problem (as discussed by Lilja & Wiklund, 2007).

Second, *information to the improvement system*: How and what information was available as input to the improvement system. Coherent systems had mature performance measurements as well as timely, frequent, and accurate communication between work groups (analogous to the relational coordination concept; Gittel, 2000).

Third, *the proximity of the improvement system*: How close (physically and mentally) to the work system the improvement system operated. An example of close proximity is when improvement work always happens at the

shop-floor (Gemba) and an example of far proximity is improvement sessions at off-sites. The improvement system in the investigated case increased its proximity over the time period for daily problem solving, but at the same time complemented with off-site activities for more radical improvement activities. Mature improvement systems thus tend to have a broader repertoire of proximities and choose the proximity depending on the improvement task.

Fourth, *the frequency and duration of the improvement activities*: How frequently improvement activities were initiated and for how long they lasted. The improvement system in level 2 was rarely used whereas the system in level 4 was activated daily. The duration of the activities varied for different types of improvement. In general the immature improvement system tended to only use improvement activities with a short duration such as time-limited kaizen events whereas the mature improvement system performed long lasting activities, sometimes for weeks. The level 4 improvement system in the investigated case even had standard work for managers that implied 4 hours of daily improvement focus at the shop-floor and also full-time employees for updating work standards based on continuous improvement feedback from operators.

Fifth, *the implementation approach*: How the improvements were implemented and sustained. The development of dynamic capabilities revealed a shift in approach to implementation of improvements. Initially, the view was that an improvement was an idea or theoretical solution without much effort put into understanding how it became integrated into the work system. Later, during level 2 the implementation approach shifted to focus on improvements as technical changes such as updates in the standard operation procedures, the software, or adjustments of the machinery. During level 3 the terms containment and countermeasure entered the shared vocabulary and the implementation approach developed further to include process confirmation by managers who would check in practice whether a proposed solution in fact did lead to sustained behavioral changes. In level 4 the implementation approach matured even more, which was clear in the managers' active discussions about how to create improvements that showed considerations of both technical changes and changes of habits and routines. This change in thinking led to a new implementation approach with emphasis on integrating training, use of simple work standards rather than less accessible standard operational procedures, and continuous process confirmation activities aimed at reinforcing successful behavior (as discussed by neuroscientists Rock & Schwarz, 2006).

Congruent Coherence within the System

Further analysis was also carried out to highlight the congruent coherence. The improvement system's elements became increasingly coherent as dynamic capabilities were developed. Thus, the organizational settings matured along with the improvement processes. Mature and coherent organizational settings designate congruent fit between the elements comprising the improvement system, which led to more effective improvement processes. Congruent fit meant that the elements in unity supported the effectiveness of the improvement process, such as when the improvement method was carried out by competent participants, supported by appropriate technology, coordinated through enabling management, and organized with synergies between different work groups.

The mature improvement system showed signs of effective internal coherence in the way each of the elements supported the improvement process as described in the following. Since the mature improvement system was well bridged with the work system, the improvement process was activated effectively with contextual information that allowed a conscious choice about improvement method, including whether to address issues as single loop learning or to engage in double loop learning for long-term benefit.

The improvement system's technology was congruent with the improvement process by 1) using effective methods for the context such as problem solving for technical problems and appreciative inquiry for unrealized opportunities, 2) using an effective work space with improvement boards with data, proximity to the shop-floor for looking at the actual situation, and both meeting rooms at the facility and available off-site spaces close by, and 3) using effective tools and objects depending on the improvement process such as boundary objects (Carlile, 2002) for discussing with people from different departments, and software for simulations and calculations.

The mature improvement system also had fit between the participants' competencies, motivations, and the improvement process. The employee turnover in the time period was low compared to the industry average and the company invested massively in professional education, but maybe more importantly, the participants were encouraged to experiment and develop through learning by doing. Also, the yearly assessments of employee engagement showed that the participants were generally very engaged at work, which could be attributed to a broad understanding of the strategy and the funny business events.

The management activities and improvement process also were quite congruent as all the managers spent hours daily at the shop-floor for either coaching improvement activities or supporting the daily work. Additionally, the daily improvement coordination meeting meant that managers' efforts were optimized.

The improvement system developed coherence between the improvement process and the organization through dividing the roles and responsibilities between different organizational entities such as having two operators dedicated to peer training and updating standard work.

The Improvement System Framework

The investigated case company developed dynamic capabilities by developing an improvement system with internal and bridging coherence. This development represented the emergence of new organizational settings as well as a new culture. The nature means that congruent fit and bridging coherence cannot be regarded as definite

attributes that are accurately measurable or predictable. Rather, congruent fit should be viewed as a mental model for understanding how to adjust the elements' interactions could develop the improvement system further.

The five bridging coherence factors are issues to consider when assessing the connection between a work system and an improvement system. The study shows how the development of bridging coherence means increasing the reflexive ability of how to engage the improvement system. The immature improvement systems only possessed few choices of engaging the improvement system such as activation through reactive problem solving, limited information sources, one proximity level, one frequency and duration, and one implementation approach. The mature improvement systems on the other hand possessed a reflexive ability to decide an appropriate configuration of the five factors to match the challenges. That is, how to combine reactive and proactive activation, several information sources to pick between, the ability to shift frequencies and duration, and different implementation approaches depending of the character of the improvement activity. Maturity of the bridging coherence meant simultaneous development of broader options, better competence in each, and a reflexive ability to decide what to do.

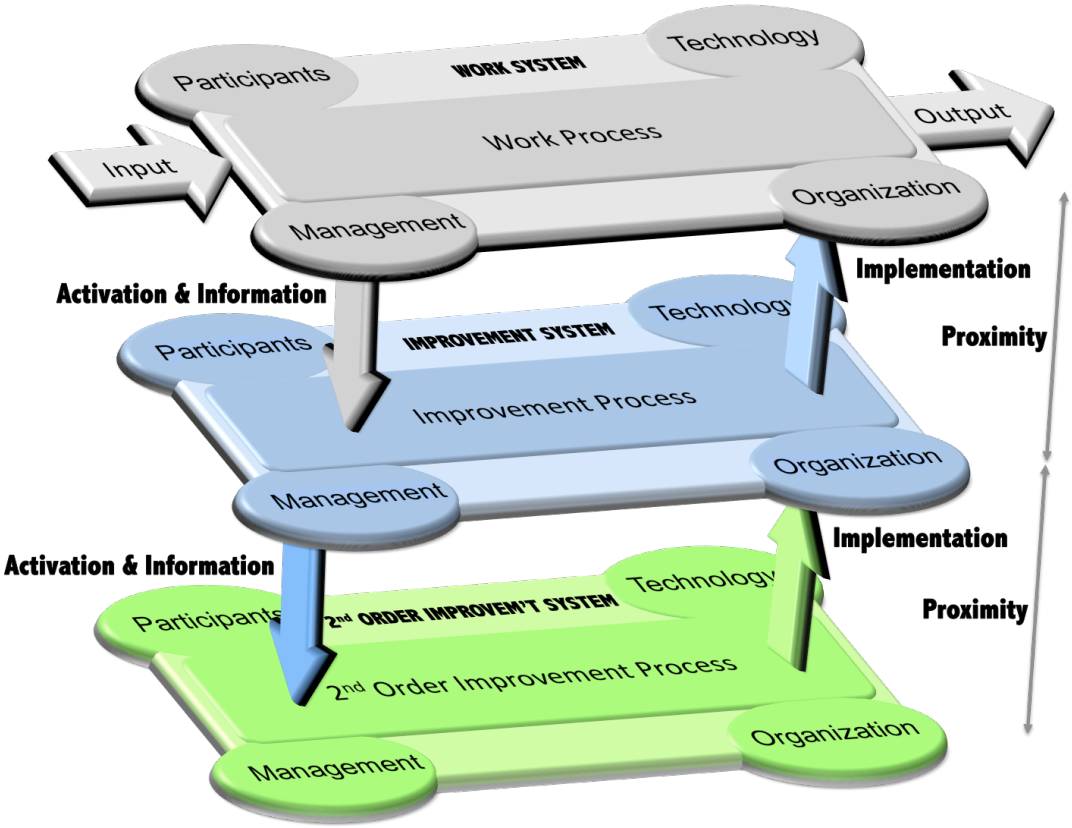
The examples show that maturity implies an increasing number of combinations, which means that an improvement system should not be viewed as a static entity but rather as a pattern of possibilities. A more mature improvement system has a broader repertoire of possibilities and more competence in deciding what to do, analogous to Kogut and Zander's (1992) notion of combinative capabilities. The understanding of the improvement model can be inspired by a biological metaphor, DNA. The characteristic features of an organism (the genotype) are described in the DNA. Every time the DNA is copied to form a new organism, the actual features vary (the phenotype), although the DNA is the same. Thus, an organization's improvement system should be seen as the DNA from which it produces well-configured improvement activities. The improvement system can be the organizational setting for different types of improvement processes with different aims and methods.

The empirical study showed examples of how the actual improvement activities could vary significantly although they were produced by the same improvement system. For example, both exploitative and explorative improvements happened simultaneously during level 4. This exemplifies how a mature improvement system may be an approach to achieve organizational ambidexterity (Tushman & O'Reilly, 1996). Benner and Tushman (2003) argue that process management favors exploitation over exploration due to path dependence and therefore suggest structural solutions to ambidexterity where the exploiting and exploring improvement systems are structurally divided. But, Gibson and Birkinshaw (2004) argue that another approach is possible, contextual ambidexterity where the capacity to achieve both exploitation and exploration is integrated within the same entity instead of by structural division. This corresponds to the examples where the same improvement system worked as organizational setting for different types of improvement activities.

Exhibit 5 summarizes the descriptions of the three systems in a framework. The improvement system framework shows the five elements of each system and how the systems are bridged. The framework illustrates how the improvement system is a stable pattern of collective activity that systematically generates and modifies operating routines. Thus, the improvement system is the operationalization of dynamic capabilities.

Exhibit 5. The improvement system framework.

Shows the bridging coherence between the work system, improvement system, and second order improvement system.



Consolidation of the findings

In order to test whether the findings of the study added to the practical understanding of dynamic capabilities, the ideas were tested in three other contexts. Three companies were identified who had a strategic need for developing dynamic capabilities: A medical devices factory, a pharmaceutical factory, and a global distribution facility of a toy manufacturer. Each company was approached and a meeting was set up to discuss the findings. During the meetings the companies' challenges with developing dynamic capabilities were discussed and the study's findings were presented based on the interconnected framework in Exhibit 5. The meetings were used to test whether the framework added value to the discussions about dynamic capabilities and helped the companies understand their current situation or what future state they desired.

The discussion at the medical devices factory concluded that they considered their improvement system fairly effective with good internal coherence between the elements. However, after discussing the framework with the three systems, questions came up about how good the bridging between the work and improvement systems was. They rarely initiated systematic improvement processes although they did have the need for thorough problem solving. This realization led to further curiosity about whether the next step for improving dynamic capabilities should be better initiation and not better problem solving competencies. Also, they had recently started a project about how to ramp up a new product and had decided to have monthly coordination meetings between the management team to adjust their improvement activities. Through the framework they realized how these coordination meetings could be considered part of a second order improvement system and not just isolated meetings. This perspective would allow for designing a coherent second order improvement system with effective fit between the technology, participants, management, and organization.

The discussion at the pharmaceutical factory revealed that they had a mature improvement system with good congruence between the system's elements. Still, they desired to enhance the effectiveness of the improvement system as the pharmaceutical industry's regulations imply major costs related to non-conformity and process deviances. Higher quality in continuous improvement could therefore lead to major cost reductions. The factory had already initiated a large program for improving their improvement system, which could be considered a second order improvement system. After being introduced to the improvement system framework the dialogue opened up and became more systems focused, i.e., the program's elements were discussed in terms of their internal congruence and how

to improve bridging. The broader dialogue led to new ideas about what to consider for optimizing the program's effectiveness.

The discussion with the global distribution organization revealed a desire to develop dynamic capabilities, as they experienced an increasing need for continuous change. They had recently initiated a leadership development process for all leaders of the global organization. However, they had not viewed the challenge of dynamic capabilities in a systems perspective, only how to develop the necessary management skills. The presentation of the framework allowed a shift in focus to consider broader actions such as how to organize improvement work, what competencies the employees need, if new methods or tools are necessary, and whether to initiate second order improvement activities.

These discussions consolidate the findings and conclude that practitioners who want to develop dynamic capabilities should use the paper's findings to review three issues: First, they should review whether their improvement efforts could be improved by focusing on the internal coherence in the system. Second, they should discuss how effective the bridging between the work system and improvement system is, which should include initiation, information, and integration. Third, they should consider whether a second order improvement system would be feasible in their specific context.

How to develop dynamic capabilities

The study revealed how the company worked on developing dynamic capabilities over several years. This development of dynamic capabilities happened through a significant transformation in how the company worked on improvements from a few systematical activities before 2006 to an effective and coherent improvement system in 2013. The change happened through radical changes in management behavior, employee competences, daily routines, new organization, new technology such as data collection systems, visual performance boards, and much more. That is, the transformation addressed the entire system and was not just an introduction of new methods, but rather represented a holistic transformation.

As an addition to the paper's focus on describing dynamic capabilities, a few recommendations for practitioners will be given on how to address the transformation process.

First, the study showed that a transformation from no systematic improvement to mature dynamic capabilities takes years even with top-management focus, employee support, and dedicated people to champion the transformation process. Also, note that the development from structured and systematic continuous improvement (level 2 of Bessant & Francis, 1999) to strategic continuous improvement (level 4) took five years, which shows the necessary degree of focus and commitment.

Second, the transformation process was highly supported by interventions that highlighted the company strategy and purpose. The beginning of the transformation process in 2006 was initiated by a purpose-driven large-scale activity and from 2009 a clear strategy-driven visual identity everywhere in the facility, including the 8 foot tall mountain monument. On almost all occasions where the managers had the opportunity they stressed the strategic importance of reaching the mountaintop as best in class in order to survive. This even got embedded into the language where team leaders as well as employees would use the terms *mountain leadership* and *best in class* or mountain metaphors such as *pulling each other up the cliff* and *aiming for the top*. The understanding of the strategy through the mountain language and symbols in the facility often acted as guiding principles and motivation during improvement work. These examples show how the important alignment of the organization's purpose and the improvement activities can be carried out in practice, as stressed by Bessant and Francis (1999) and Anand et al. (2009). Furthermore, the use of a guiding metaphor appeared as an important factor in the transformation process, which is also a central finding in a meta-study of transformational change processes by Bushe and Kassam (2005).

Third, an insistence on the use of large-scale events such as frequent and strategic off-sites with all employees and *funny business events* at the facility revealed a management focus on engaging everyone toward a desired future state as well as building shared understanding and focus. This approach could accelerate transformation by accentuating what Cooperrider and Srivastva (1987) call the constructionist principle and Cooperrider (2000) further discuss as the actionable power of the positive image.

Fourth, a huge emphasis on continuous leadership development was evident in the company. This showed through frequent leadership development activities such as the monthly *leadership breaks* for all managers and between 5 and 25 days of leadership courses per manager per year. Furthermore, the extensive use of coaches for improvement work and management behavior further stressed the constant emphasis on creating an environment for leadership development. From 2011 the company introduced internal leadership coaching where all managers had to coach their direct reports on the shop-floor in leadership behavior. The daily performance meetings at the department level also showed an increased focus as an arena for performing and developing leadership behavior. This showed in the shifting focus from information sharing to active reflections and sparring sessions on management behavior. The company's high regard of the leadership development was evident, as all managers in the production had been promoted to new jobs in the company in 2011. Furthermore, leadership development was not limited to managers in formal positions; also informal leaders were encouraged and supported to use their strengths to champion change and improvement efforts. These informal leaders created some of the more radical improvements such as the changed manning plan, which required severe lobbyism at the unions, among employees, and in the company's other departments. This change approach is similar to Kotter's (2012) idea about a dual organizational system for facilitating change where volunteers engage in parallel with their regular jobs. The

leadership development examples also correspond well with the finding that transformational leadership is positively correlated with successful quality management implementation (Hirtz et al., 2007).

These four highlighted points add new insights to the call for further research on how to facilitate cultural change in Lean thinking from Liker and Morgan (2011). Lean production should not be developed with focus on the operational work system but instead on developing a coherent improvement system. This approach requires dedication and long-term investments. In addition to the cost and efforts required for developing dynamic capabilities, the study indicates that the costs of sustaining dynamic capabilities are also high (as discussed by Winter, 2003). Thus, companies that choose a strategy dependent on dynamic capabilities should be ready to invest not only in developing but also in sustaining them. If not ready to invest, ad hoc problem solving may be a more viable approach.

This paper adds to the understanding of dynamic capabilities in Lean production and their development over time. However, further research is necessary to test and consolidate the paper's findings. Especially, the question about how to develop dynamic capabilities over time requires emphasis.

Conclusion

The paper shows how a manufacturing company worked on developing dynamic capabilities from 2006 to 2013. The in-depth empirical study concluded that the company developed dynamic capabilities and used them strategically for competitiveness as a ramp-up facility for the production of new pharmaceutical devices.

The study showed that dynamic capabilities arose from the development of an organizational setting for improvement activities, the improvement system. This system comprised of five elements: an improvement process, participants, management, organization, and technology. The paper shows how the effectiveness of the improvement system depends on the congruent fit between these five elements. Also, the effectiveness depends on the bridging coherence between the improvement system and the work system consisting of activation and information and the implementation approach.

The analysis showed that the development of the improvement system required explicit focus on changing people's mindsets and behaviors through large-scale sense-making interactions, use of metaphors, and broad leadership development rather than changing structures and procedures.

Furthermore, the study found evidence of a second order improvement system that continuously developed the first order improvement system. Further research and conceptualization of the second order improvement system could lead to key findings on how to develop dynamic capabilities and continuous improvement culture.

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Ambidextrous Continuous Improvement: A case study of Strength-based Lean leadership

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Abstract

Purpose – Continuous improvement is a central discipline in operations management. However, prevalent continuous improvement approaches (e.g., Lean) have been criticized for leading to short-term efficiency while inhibiting long-term improvements. The solution to this problem is the organizational ability ambidexterity, i.e., the ability to improve performance through both exploitation and exploration. For decades, however, this ability has been acknowledged as a challenge due to the seeming incompatibility of exploitation and exploration. Yet, studies suggest that some companies utilizing continuous improvement do achieve ambidexterity. This paper investigates how this can be achieved by exploring the role of improvement leadership approaches. Two improvement leadership approaches were studied: Strength-based leadership and problem-solving leadership.

Design/methodology/approach – An explorative case study was carried out at a manufacturing facility for 12-months. The two improvement leadership approaches were investigated in-depth during 10 improvement projects, lasting from a week up to two months. Qualitative data from observations and interviews was used to analyze whether the improvement leadership approaches created contextual ambidexterity.

Findings – The paper shows how the improvement leadership approach determines whether improvement activities exploit or explore. The empirical study confirms that different improvement leadership approaches can co-exist within one organizational entity. These findings demonstrate how contextual ambidexterity can be achieved through explicit design of the improvement leadership approach, either through combining different approaches or by using one dynamic approach. Finally, the paper presents a framework for explaining the mechanisms that lead to exploration and exploitation.

Practical implications – The paper shows how practitioners can approach contextual ambidexterity through the improvement leadership approach and presents a framework for customizing improvement approaches for various organizational needs.

Research limitations/implications – The research was based on a single case study, which means that the findings may lack generalizability. Further research is encouraged to challenge the findings and to investigate them in other contexts.

Originality/value – This paper is the first to investigate the improvement leadership approach as an enabler for contextual ambidexterity. Also, the paper is the first study of strength-based approaches in operations management.

Keywords – Ambidexterity, Continuous Improvement, Strength-based Lean Leadership.

1. Introduction

Continuous improvement has been a central topic in operations management since its very beginning (Taylor, 1911). Since then, operations management has recognized how organizational efficiency can be improved through systematic process analysis and improvement (Deming, 1982; Delbridge and Barton, 2002). Yet, continuous improvement has been criticized for being efficient in the short run while leading to stagnation, or even decline, in the long run since the capabilities that create efficient execution impede learning and flexibility (Benner & Tushman, 2003). Thus, the exploitative capability for short-term efficiency needs a complementary mode leading to long-term success. The two modes may seem incompatible and can be challenging to manage simultaneously, which Abernathy (1978) termed the productivity dilemma.

Organizations in a dynamic environment not only need to exploit their current resources and capabilities, they also need to be able to explore new opportunities to achieve long-term success. This core capability for both short and long term improvement is called ambidexterity and has been studied for decades. But ambidexterity is challenging due to the inherent incompatibility between exploitation and exploration (March, 1991). This challenge is still subject to an ongoing discussion (Adler *et al*., 2009) and still relevant for practitioners of continuous improvement such as Lean production (Benner and Tushman, 2003). Two solutions to the ambidexterity challenge have been proposed: First, Tushman and O'Reilly (1996) suggest structural ambidexterity, i.e., the organizational division between the exploiting and exploring functions. Second, Gibson and Birkinshaw (2004) on the other hand suggest a solution by means of integrating the ambidextrous capacity in the organizational behavior instead of in the structure. They term this contextual ambidexterity and define it as the behavioral capacity to simultaneously demonstrate alignment and adaptability within a business unit. Contextual ambidexterity has recently been acknowledged as a possible approach to balancing continuous improvement between improving existing processes and for designing new processes (Jansen, 2006; Anand *et al*., 2009).

However, research on how to achieve contextual ambidexterity in continuous improvement is limited. Continuous improvement is criticized for emphasizing exploitation (Benner and Tushman, 2003), yet Takeuchi *et al*. (2008) describe how Toyota, a role model for continuous improvement, consistently shows ambidextrous capabilities by demonstrating superior manufacturing efficiency over time even when quick product development requires the manufacturing processes to be radically changed. Thus, ambidextrous continuous improvement is possible, but there is a lack of knowledge about how to proceed, even though the thinking and methods from the Toyota Way have been thoroughly described and used (Lewis, 2000; Liker, 2004; Hines *et al.*, 2004; Bateman, 2005; Arlbjørn and Freytag, 2013). Since consistently few sources report satisfaction with their long-term outcomes of continuous improvement (Anand *et al*. 2009), this implies that the dilemma has not been solved.

Recently, a number of studies have looked into the role of individuals for achieving ambidexterity and they suggest that leadership can play a crucial role in balancing exploitation and exploration efforts (Sen, 2010; Lin and MacDonough, 2011; Probst *et al*., 2011; Tushman *et al*. 2011; Bonesso et al, 2013). Consequently, the key to achieving ambidexterity may lie in the leadership capacity to initiate and execute continuous improvement activities in different contexts. Inspired by the problem-finding and problem-solving approach (Nickerson *et al*., 2013) this paper will focus on

how different leadership approaches find, frame, and formulate problems or opportunities for improvement.

The prevalent improvement leadership approach in continuous improvement is the problem solving approach (e.g. Berger, 1997; Kaye and Anderson, 1999; Kerrin, 1999; Terziovski and Sohal, 2000; Delbridge and Barton, 2002; Jørgensen *et al*., 2003; Liker, 2004; Shook, 2008; Liker and Convis, 2011). However, the problem solving approach has been criticized for inhibiting creative thinking, limiting new knowledge generation, and for creating defensive posturing and discouraging action (Cooperrider and Srivestra, 1987; Barrett, 1995; Neilsen, 2005; Shendell-Falik *et al*., 2007; Baaz *et al*. 2010). This criticism may explain the bias of the approach towards exploitation.

An alternative improvement paradigm has suggested a shift from problem focus to strengths focus, i.e., building on what works, learning from positive deviations, and emphasizing affirmative future images (e.g. Appreciative Inquiry: Cooperrider and Srivestra, 1987; Cameron *et al*., 2011). This particular leadership approach has been termed strength-based leadership (Brun and Ejsing, 2012) and has shown capability for creating transformational organizational change (Bushe and Kassam, 2005; Cooperrider *et al*. 2008). This improvement leadership approach may hold a bias towards exploration and combined with problem solving be a key to achieving contextual ambidexterity.

This study explores two issues: First, whether different improvement leadership approaches can facilitate different practices of exploration or exploitation. Second, whether the two improvement leadership approaches can co-exist within the same organizational entity and create contextual ambidexterity. Based on an explorative case study in a single organization the paper answers the research question: Can a combination of improvement leadership approaches lead to the behavioral capacity for contextual ambidexterity?

This paper will be introduced with a literature review that clarifies the conceptual terms in understanding organizational ambidexterity and the two leadership approaches. Then, the research design will be described and the empirical findings presented. Finally, the findings will be discussed and suggestions for practitioners will conclude the paper.

2. Understanding Organizational Ambidexterity

The contextual ambidexterity concept means that a favorable context can enable individuals to organize their work in a way that integrates both exploitation and exploration concurrently. This solution emphasizes the role of processes and systems for encouraging individuals to make their own judgments on how to divide their time between the two modes (Gibson and Birkinshaw, 2004). Contextual ambidexterity thus means two things: (1) The organizational setting should support both exploration and exploitation, and (2) individuals need a behavioral capacity for deciding when to focus on what and for delivering in both modes.

Contextual ambidexterity thus depends on organizational factors such as the type of bureaucracy, i.e., coercive or enabling as discussed by Adler *et al*. (1999), as well as the behavioral capacity for leaders to ensure resource availability, goal-setting, trust, and leadership support (Choo *et al*., 2007). In the following definitions and units of analysis for studying contextual ambidexterity will be discussed.

2.1 Exploitation and exploration

Adler *et al.* (2009) discuss the productivity dilemma between exploitation and exploration as a challenge between old and new knowledge. As old knowledge

accumulates it can turn into organizational routines, i.e., stable, predictable, and repetitive activities. Routines enable organizations to exploit resources to increase efficiency. However, routinization creates the risk that the old knowledge inhibits new knowledge generation. New knowledge is necessary when the environment changes and adjustments become necessary for achieving effectiveness. The productivity dilemma becomes a choice between short-term or long-term efficiency. As the two modes compete for scarce resources, all organizations make explicit and implicit choices between the two (March, 1991).

March and Simon (1993) define exploitation as leveraging existing knowledge and capabilities resulting in stable and efficient performance. Exploration is defined as creating new knowledge, enabling organizations to innovate and adapt to changing conditions. While there is consensus about the view that exploration involves learning the view on exploitation is unclear. The definitions also lack operational meaning at the work level unit of analysis (Baum *et al*., 2000; Benner and Tushman, 2002) since many studies use entire firms as units of analysis, which means that their definitions are rooted in product-market innovation rather than process innovation. Gupta *et al*. (2006) argue that definitions of the two terms should be differentiated by the type of learning they involve, and that the definitions should depend on a clear choice of unit of analysis.

This paper is concerned with the improvement of an operational work system as unit of analysis. Based on the suggestions by Gupta *et al*. (2006) and inspired by the definitions by Baum *et al*. (2000) and Benner and Tushman (2002) the following definitions will be used for the two types of improvement activities:

- Exploitation is an improvement activity that uses existing components and architecture and builds on the existing improvement trajectory.
- Exploration is an improvement activity that involves a shift to a different improvement trajectory.

2.2 Improvement trajectories

The definitions of exploitation and exploration emphasize a focus on work system improvement and use the term improvement trajectory, which is an elaboration of the term technological trajectory, often used for discussing product-market innovation. An illustrative metaphor for understanding the term improvement trajectory is Christensen's (1992) technology S-curve theory shown in Figure 1.

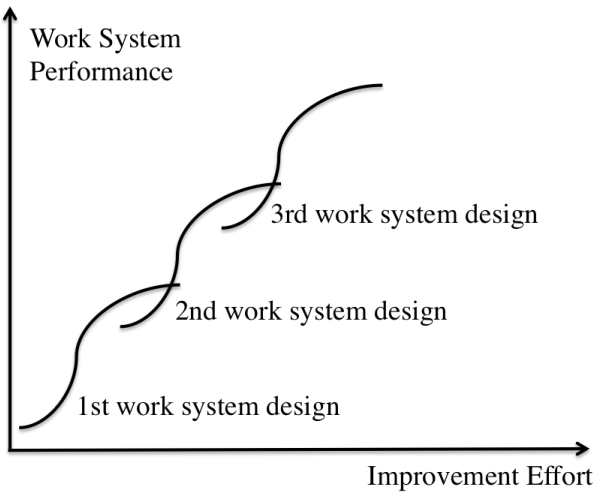

Figure 2. S-curve theory for work system improvement

Every work system design has a performance limitation that can only be overcome by a system-design change, for example a whole system paradigm-shift such as moving from batch to flow manufacturing. Exploitation is an improvement activity within a paradigm that follows the current improvement trajectory, which can be illustrated as following one particular S-curve. Exploration on the other hand is characterized by not following the current improvement trajectory but by shifting to a new trajectory, which may or may not lead to a new work system design.

Dosi (1982) uses the term trajectory to describe the pattern of normal problem solving activity of creating solutions to selected problems based on selected principles and methods. These selections are based on a paradigm defined as *an "outlook," a set of procedures, a definition of the "relevant" problems and of the specific knowledge related to their solution*. Each paradigm has established a concept of progress based on the specific trade-offs, e.g. between economic and technological factors, and describes a mental model for identification of problems and valid solutions.

An improvement trajectory describes the direction for the normal improvement activities based on a mental model of relevant problems and valid solutions. As an example, the continuous improvement activities at a manufacturing plant will be guided by a mental model of relevant problems such as a need for improving efficiency or quality and the solutions will be guided by a mental model of valid solutions such as updates to work standards, employee training, etc.

The improvement trajectory is similar to the concept of path dependence from dynamic capabilities literature (e.g., Teece *et al.*, 1997). The notion of path dependence implies that options about domains of competence are influenced by past choices. Teece *et al.* (1997) elaborate: "At any given point in time, firms must follow a certain trajectory or path of competence development. This path not only defines what choices are open to the firm today, but it also puts bounds around what its internal repertoire is likely to be in the future. Thus, firms, at various points in time, make long-term, quasi-irreversible commitments to certain domains of competence" (Teece *et al.*, 1997). This concept is also compatible with the s-curve metaphor.

One question remains: How different are the improvement trajectories and paradigms? The s-curve metaphor is ambiguous since the definition of a paradigm and an improvement trajectory depends on the unit of analysis. At times when work systems have changed radically, it is clear than they have shifted paradigms, but the process will probably not take place in one step. Liker (2004) argues that Toyota's breakthroughs in manufacturing as well as product development happens through a series of incremental steps that add up to a radical change. For example, the radical product innovation process that created the Prius hybrid car consisted of thousands of incremental steps, not a few leaps. This view argues that each s-curve consists of even smaller s-curves and that transition between curves may not happen through one giant leap but rather through a series of small steps that end up changing the mental models that comprise the s-curve.

This paper addresses the question of how to develop along s-curves (exploitation) and transition between s-curves (exploration) through investigating the role of the behavioral capacity that lies in the improvement leadership approach. Improvement leadership will be discussed in the following section.

3. Improvement leadership: Two different approaches

Nickerson *et al*. (2013) discuss the role of leadership for organizational improvement. They present the Problem-Finding and Problem-Solving approach as a model for

understanding how organizations create and capture value based on three questions: (1) How leaders find, frame, and formulate problems and opportunities for improvement, (2) how leaders organize knowledge sets to search for and efficiently create valuable solutions to the chosen opportunities or problems, and (3) how leaders implement the solutions. While many other factors may also affect how organizations improve and whether they exploit or explore, this paper will focus on the role of the first two questions in the Problem-Finding and Problem-Solving model, which means that other leadership factors will be omitted. These two questions can then be used to characterize different improvement leadership approaches. In order to investigate the role of improvement leadership for achieving ambidexterity, this paper investigates two different improvement leadership approaches: The problem solving approach and the strength-based approach.

3.1 The problem solving leadership approach

The typical leadership approach to continuous improvement is problem solving through root cause thinking (Delbridge and Barton, 2002; Liker, 2004; Rother, 2010). Through investigating undesired events and understanding their cause the method ensures permanent solutions to problems by eliminating the problem's root. Specific methods include Deming's PDCA circle, Six Sigma's DMAIC method, and Lean's A3 systematic problem solving (i.e., Toyota Business Processes, Shook, 2008). In order to investigate the differences between two extreme cases, the definition of the problem solving leadership approach for this paper is a simplified stereotype. More mature problem solving approaches such as at Toyota (as presented by Takeuchi *et al*., 2008; Rother, 2010) will be discussed later in this paper.

The stereotypical problem solving approach finds problems by identifying a gap between a target condition and the measured current condition, i.e., the concern. Then, after grasping the situation the problem is formulated in terms of a problem statement. Thereafter, knowledge is gradually collected in order to identify the direct cause of the problem, i.e., where the problem occurs. Then, the underlying root cause can be found by analysis, such as by asking a series of why-questions, e.g., "why did the direct cause happen?" and "Why did the cause of the cause occur?"

A descriptive metaphor for the problem solving approach is a funnel where focus gradually narrows until the 'correct' point of the cause is found, and then investigated through why-questions until the root cause is identified (Liker, 2004). Solving the root cause implies addressing not just the apparent surface of the problem but a deeper underlying problem. Finally, this knowledge is used to design a countermeasure that can eliminate the root cause and ensure the problem will not reoccur.

3.2 The strength-based leadership approach

The strength-based approach is based on the ideas from Cooperrider and Srivestva (1987) who realized that social change occurred faster and more creatively when the change efforts focused on expanding existing success experiences rather than identifying problems to eliminate. Based on this finding, they developed Appreciative Inquiry as method for defining preferred future states and building competence to achieve them. This method has since evolved into a strength-based approach to improvement, inspired by Seligman and Csikszentmihalyi (2000), Buckingham (2005), and Cameron *et al*. (2011). A stereotype of the strength-based approach is used in this paper based primarily on Appreciative Inquiry (Cooperrider *et al*., 2008) with the five principles shown in Table 1.

Table 1. The principles of the strength-based approach.

***Anticipatory principle*:** Actions are guided by images and expectations of the future, i.e., positive future images create positive actions.
***Constructionist principle*:** Everyone who needs to be part of the change should participate in the construction process in order to understand the new future.
***Poetic principle*:** The issues that get attention grow in people's minds; the change thus needs to develop and sustain a new language for the desired future state.
***Positive principle*:** Building momentum for change requires positive affect and social bonding such as hope, excitement, inspiration, and urgent purpose.
***Simultaneity principle*:** Change begins with the questions asked, and analysis cannot be isolated from implementation.

The strength-based approach can be initiated from either a problem or an opportunity and follows these steps (Cooperrider *et al*., 2008):

1. After finding a problem or opportunity to address, it is reframed and formulated into an affirmative topic. That is, a compelling and attractive question to answer for the organization. The affirmative reframing is a critical part of appreciative inquiry. An affirmative topic reformulation can for example transform "how do we eliminate the team's low productivity and high absenteeism?" into "how do we become a high performance team where everyone comes to work and uses their top strengths every day?" The difference in commitment and opportunities for action is remarkable and shows the simultaneity principle in action; this question alone initiates an improvement journey.
2. Discovery of success factors is the process of investigating the knowledge that already exists in the organization that can help answering the affirmative topic. For example, positive experiences, strengths, useful knowledge, people's motivation to succeed, etc. By sharing stories that illuminate success factors the poetic and positive principles are put into action.
3. Creation of a shared future dream. Here, the appreciative inquiry leadership approach wants to engage as many participants as possible in co-creating and visualizing a preferred future state. This process activates the constructionist and anticipatory principles and prepares people for the change to come as well as enables them to begin improvement efforts within their own sphere of influence.
4. Design of solutions for realizing the future state. The solutions should be provocative in the way that they make people think and act in new ways. New knowledge creating is key, e.g., through experimentation or prototyping based on design thinking (Cooperrider and Godwin, 2011). Successful initiatives often create a guiding metaphor that continues all the way though implementation (Bushe and Kassam, 2005).
5. Implementation of solutions. Often, the appreciative inquiry initiatives that lead to transformational change are implemented based on personal engagement and initiative action rather than deployed responsibility (Bushe and Kassam, 2005).

3.3 The improvement step framework

The difference between the problem solving approach and the strength-based approach can be illustrated in a framework that describes improvement steps for the initial stages of improvement, see Figure 2. The problem solving approach starts from a problem statement (1) that describes the negative gap between the current state and the target

state. Then root cause analysis (2) is used to collect knowledge for understanding the gap. Finally, countermeasures are identified in order to design solutions (6) and implement them.

The strength-based approach finds opportunities for improvements, either by identifying a negative deviance, a positive deviance, or through an idea about a better future state. This opportunity is then reframed and formulated as an affirmative topic (4), thus shifting focus from "what to eliminate" to "what should be created". Next step is to create momentum by identifying the best practices to sustain and collecting knowledge from previous success experiences, i.e., success factor analysis (5). This step systematically collects knowledge from participants about factors they know affect the affirmative topic, as well as uncovering tacit knowledge. Next step is a positively guiding future state visualization (3). Finally solutions are designed and (6) implemented.

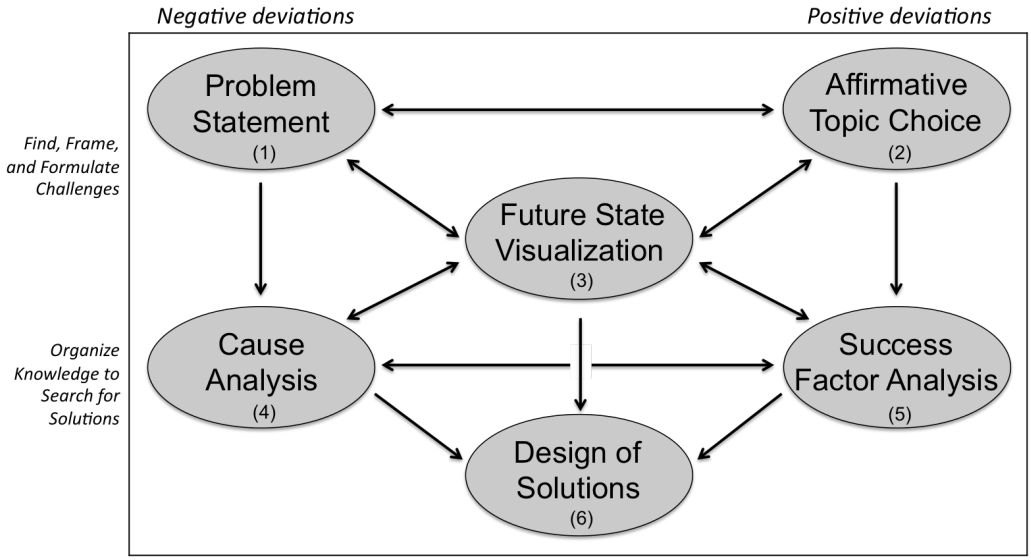

Figure 2. Improvement Step Framework for the Initial Stages of Improvement

The improvement step framework can be used to characterize improvement leadership approaches based on what steps they use. The problem solving approach consists of the steps (1), (2), and (6). The strength-based approach consists of steps (4), (5), (3), and (6). A number of hybrid approaches will combine the steps in various ways. The arrows represent possible paths through the improvement step framework that create the various improvement approaches. Other improvement leadership approaches exist such as the Toyota Kata (Rother, 2010) and Solutions Focus Thinking (Jackson and McGregor, 2007), but this study focuses on the problem solving approach and the strength-based approach.

4. Research methodology

The research question was broken down into three sub-questions:

a) Can the two improvement leadership approaches co-exist within the same organizational setting?
b) What type of improvement activities do the two improvement leadership approaches facilitate?
c) Can the two improvement leadership approaches combined create contextual ambidexterity?

In order to study these questions a research strategy was decided for studying the leadership approaches in-depth within their real-life context. An explorative case study was used (Yin, 2003). In order to investigate contextual ambidexterity the case study was carried out within a single organization to get a deeper understanding of the organizational context and to avoid the influencing factors that could exist between different companies. Qualitative data collection methods were used to emphasize rich explanatory data.

4.1 Case organization

Based on the knowledge from an earlier study, an organization, strategically interested in ambidexterity and using the problem solving approach as well as the strength-based approach, was identified. The organization was a medium-sized pharmaceutical devices manufacturing facility that had worked with Lean and the problem solving approach for seven years as well as the strength-based approach for three years. This facility functioned as a ramp-up facility for new product introduction and their role was therefore to excel in improvements until the production system had grown mature enough to outsource it to another country. This operation strategy often created dilemmas, as the facility often needed to balance exploitation to deliver products for the short-term demand or to explore ways of improving the production system, which might cost on short-term delivery. Based on these demands, the facility actively experimented with different improvement leadership approaches that made the facility ideal for an explorative case study. The facility agreed to give the researchers open access to study the facility and its improvement efforts for a period of 12 months.

The unit of analysis for this study is improvement activities and the role of improvement leadership during the activities. Since many factors outside the improvement leadership approach can affect the outcome of improvement activities the researchers spent substantial time to become familiar with the case organization and its leaders, before engaging in the data collection in order to pick comparable cases that were not corrupted by other factors, e.g., by sampling between improvement activities facilitated by a homogeneous group of leaders.

4.2 Design and sampling

The research was designed to take advantage of the longitudinal availability by allowing for iterative data collection. First, a pre-study was carried out to investigate whether the problem solving approach and the strength-based approach co-existed and to find out how the leaders used them. Second, the effect of the leadership approaches was studied by following specific improvement activities in order to investigate how the approach had an impact on the improvement type. Sampling criteria for the study of improvement activities were three problem solving cases, three strength-based cases, and any type of hybrid cases that turned up while investigating the others. The following procedure was used:

1. Select a relevant improvement activity case based on sampling criteria
2. Study the improvement activity case through qualitative data collection
3. Transcribe the activity into a narrative, and characterize the leadership approach used based on the improvement step framework
4. Repeat 1-3 until all sampling criteria have been fulfilled
5. Analyze the effects of the improvement leadership approaches
6. Discuss the research questions based on the analysis.

4.3 Data collection and analysis

The improvement activities at the facility were very different in nature, ranging from two to a hundred participants and lasting from an hour to a month. Focus during data collection was therefore set to be on getting in-depth qualitative understanding rather than seeking a large quantity for statistical conclusions.

Data collection was carried out through qualitative methods of observation as well as interviews with participants. Key informants were the leaders who either facilitated the improvement activities or were responsible for their execution. Often, the interaction took place as participant observations during the improvement activities. The advantages of participant observation include greater access to otherwise inaccessible information such as unconscious actions and deeper understanding of the context. Disadvantages include introduction of bias of the researcher and the interactions with the key informants who know the researcher is present (Kawulich, 2005). Observation data was collected in a field notebook together with copies of documents as well as with relevant pictures.

A total of ten improvement cases were investigated and categorized into problem solving, strength-based or hybrid based cases according to what improvement steps they used. Each case was transcribed into a narrative that was analyzed in terms of what improvement steps were used to characterize the improvement leadership approach.

Then, the type of improvement activity, exploitative or explorative, was determined for each case, based on whether the activity involved a shift to a new improvement trajectory. This analysis was based on interviews and the participants' own views combined with the researcher team's knowledge of the company from the longitudinal study. The definition of trajectory was taken from Dosi (1982).

5. Empirical findings

The pre-study and the ten improvement activity cases were used to answer the three research sub-questions. An overview of the investigated cases and their improvement leadership approach are summarized in Table 2.

Table 2. Summary of the cases and their improvement leadership approach

Case no.	Task definition		Knowledge collection		Goal description	Category
	Problem statement	Affirma-tive topic	Root cause	Success factors	Future state visualization	Improvement Leadership Approach
1	X		X			Problem Solving
2	X		X			
3	X		X			
4	X			X	X	Hybrid Approach
5		X		X		
6		X		X		
7	X	X	X	X	X	
8		X		X	X	Strength-based
9		X		X	X	
10		X		X	X	

5.1 Can the two improvement leadership approaches co-exist?

The first sub-question was whether the two leadership approaches could co-exist within the same organizational entity. Both of the two meanings of the term contextual were considered, i.e., whether the organizational setting could support both approaches and

whether individuals could possess a behavioral capacity for using both approaches well.

The pre-study showed how the case facility was organized to support a wide repertoire of improvement leadership approaches. Interviews revealed that all the leaders in the facility spent a significant amount of time developing their improvement leadership skills, for example by means of in-house and off-site training sessions. The facility also used a number of coaches who assisted in the development of improvement skills. Some coaches were specialists in the problem solving approach where others were experts in the strength-based approach. Moreover, the visual management set-up was flexible and allowed for varying key performance indicators depending on the current need or desire to use either approach. These factors show how the organizational setting supported the individuals in being capable of using both approaches.

The interviews indicated that the leaders felt a certain amount of tension between the different improvement leadership approaches they had been taught, and they felt on their own trying to figure out which approach to use in which situation. At the same time, some leaders argued that the structured performance management set-up biased them towards the problem solving approach through the language and norms. However, the observations over the 12-month period at the facility revealed that all of the leaders initiated or participated in strength-based improvement activities such as large-scale sessions and daily success analyses. Furthermore, the strength-based language was clearly evident in the daily work. These examples clearly show that the individual leaders did possess a behavioral capacity for deciding what improvement approach to use when, and that they were skilled in using either of them as well as combining them into hybrid approaches.

These findings demonstrate through both contextual meanings that the problem solving and the strength-based improvement leadership approaches can co-exist within the same organizational entity. Even though the leaders suggested that the one approach dominated (as suggested by Benner and Tushman, 2003), the other approach did not seem to diminish over the 12-month research period. Both approaches co-existed stably over the time-period even though they were not equally used. This suggests that a stable balance between different improvement leadership approaches is possible. Thus, it is a way of achieving contextual ambidexterity.

The next sub-question was what improvement types each of the improvement leadership approaches created, which will be described in the following sections.

5.2 What improvement types did the problem solving approach create?

A large number of improvement activities initiated by the problem solving approach were followed over the 12-month research period. Three of the activities were studied in-depth. All of them were initiated by a negative deviation from the performance standard and began with a problem statement. Then, root cause analysis was used to collect further data about the problem to get a deeper understanding of its causes. Finally, countermeasures were identified and implemented. All three activities were characterized as exploitation as they built on the existing improvement trajectory.

5.3 What improvement types does the strength-based approach create?

Three improvement activities initiated by the strength-based improvement leadership approach were investigated in-depth. They all involved the same improvement steps: First, an affirmative topic was chosen. Second, success factor analysis was carried out to collect the existing knowledge about the topic. Third, a positive future state image was defined, and finally, solutions were identified for implementation.

Two of the three cases were characterized as exploration as they involved a shift to a new improvement trajectory. Even though the third case was structured very similarly to one of the others, it was characterized as an exploitation case since the existing improvement trajectory was reinforced. Thus, the improvement steps alone are not enough to distinguish between exploration and exploitation. However, the strength-based leadership approach did favor exploration.

5.4 What improvement types does the hybrid approach create?

The hybrid cases were quite different in nature. Case 4 was similar to cases 1-3 by starting with a concise problem statement, but instead of generating knowledge about solutions based on investigating root causes, it investigated the success factors leading to positive deviations in performance. This led to a solution without needing to understand the causes of problems, but instead by understanding the actions necessary for successful solutions. The cases 5 and 6 were both based on an affirmative topic choice of sustaining a specific positively deviant performance by investigating success factors in order to create improvement. These three cases were characterized as exploiting as they built on the current improvement trajectory.

Case 7 was more complex, lasted much longer, and had more participants involved than the other cases. It was initiated similarly to a problem solving case by a problem statement and root cause investigation, but it was expanded to include the strength-based steps of affirmative topic, future state visualization, and investigation of success factors. The case addressed the original problem statement and used root cause analysis, but it also took a broader systemic view that led to questioning the paradigm that was considered originally. During the affirmative topic and future state steps the perspectives expanded and made broader ideas emerge by changing the mental model and initiating a new improvement trajectory, thereby becoming an exploration case.

The characterization of the improvement type for each case answers the second sub-question and is summarized in Table 3.

Table 3. Characterization of the Improvement Type for each Case

	Case no.	Exploitation	Exploration
Problem Solving	1	**X**	
	2	**X**	
	3	**X**	
Hybrid	4	**X**	
	5	**X**	
	6	**X**	
	7		**X**
Strength-based	8	**X**	
	9		**X**
	10		**X**

6. Discussion

6.1 Can Improvement Leadership Lead to Ambidexterity?

The third sub-question was whether the two improvement leadership approaches combined could lead to contextual ambidexterity. The empirical findings show how both improvement leadership approaches can co-exist within one organizational entity,

and that the problem solving approach favors exploitation whereas the strength-based approach favors exploration. The simple answer to the sub-question is therefore affirmative. Contextual ambidexterity can be achieved through combining different leadership approaches within the same organizational entity.

The empirical study showed how different improvement leadership approaches can co-exist within the same organizational entity and be used to address different types of challenges. The advantage of this finding is that the productivity dilemma can be addressed explicitly, for example by allowing top-management to play a role in prioritizing the needs (O'Reilly and Tushman, 2011; Probst *et al*., 2011; Tushman *et al*., 2011).

However, the study also revealed an alternative. Hybrid case number 7 utilized improvement steps from both the problem solving approach and the strength-based approach and was characterized as exploration while still emphasizing exploitation. This case was initiated with a problem statement and root cause analysis, yet carried out the steps of affirmative topic choice and future state visualization. This approach turned out to be much more dynamic than each of the other two alone. The improvement activity was initiated as problem solving, but as the challenge appeared too difficult to solve within the existing improvement trajectory, the leader decided to utilize the affirmative topic choice step in order to open up for broader options based on a new trajectory. This step opened up for exploration, which successfully handled the situation. This shows that one single improvement leadership approach can create contextual ambidexterity provided it is dynamic and that the leaders using it possess adequate behavioral capacity.

This conclusion is also suggested in the literature where Toyota's problem solving leadership approach succeeds in bypassing the seeming dichotomy between exploitation and exploration (Takeuchi *et al*., 2008; Adler *et al*., 2009). MacDuffie (in Adler *et al*. 2009) explains how the Toyota approach is gap-driven, i.e., defined by a gap between the current situation and the ideal situation. This gap can either be a reaction to a negative deviation or it can be stretching towards a somewhat distant possible future. The former activity will probably be exploiting and the latter exploring. Although the processes for envisioning and reaching these gaps are cognitively very different, at Toyota they are addressed in the same way with the same language. Their improvement approach thus bypasses the exploitation versus exploration dichotomy. These improvement activities can act as the basis for contextual ambidexterity if the improvement leaders are capable of using the method.

The advantage of using a strategy of one improvement leadership approach, capable of both improvement types, is that the expertise can become a shared practice. In that way leaders can use the same language and support each other's development, for example through improvement coaching (Rother, 2010). This improvement approach strategy can even be developed into a comprehensive and coherent leadership system for all leadership levels (Liker and Convis, 2011). A disadvantage is that, in this case, ambidexterity becomes a tacit skill that can be difficult to manage or to develop. Also, implementation of this take on contextual ambidexterity will have a risk of becoming unbalanced, for example by primarily emphasizing exploitation because the choice of shifting to exploration lies within individuals who may not be aware of their biases and implicit prioritizations because they lie within the improvement approach and becomes a tacit skill.

For organizations that need to increase either exploration or exploitation, the strategy of using more than one improvement leadership approach has the advantage that the required expertize can be specifically taught and supported.

The empirical study shows that the behavioral capacity leading to ambidexterity is possible, and that an active choice of improvement leadership approach can be the solution, either by shifting between different approaches depending on the situational context or by mastering one approach that can lead to both exploration and exploitation depending on its use.

However, the study also showed that the improvement leadership approach alone did not guarantee a particular improvement type. The following sections will discuss what a trajectory shift is, and then use the case material to investigate what mechanisms lead to trajectory shifts.

6.2 What is a trajectory shift?

The literature on ambidexterity does not explain how trajectory shifts are created. One theoretical model that may enlighten the question is the well-known concept of single and double loop learning by Argyris and Schön (1978). These two notions are used to differentiate between two different modes of learning. Single loop learning involves the detection and correction of errors without questioning the governing variables of organizational actions. Double loop learning involves learning by questioning and adjusting the governing variables that guide the organizational actions.

However, the authors who discuss exploitation and exploration with a similar definition as in this paper do not discuss single and double loop learning (March, 1991; Baum *et al*., 2000; Benner and Tushman, 2002; Gupta *et al*., 2006). Thus, it is unclear from the literature whether the single and double learning theory explains the learning modes that change improvement trajectories.

Further literature search for explanations on changing improvement trajectories discovered another concept. Barrett (1995) calls the process of changing improvement trajectories for generative learning and states that it involves thinking outside the limitations of the initial problem and going beyond the framework that created the current conditions. Gergen (1978) describes generativity as: *the capacity to challenge the guiding assumptions of the culture, to raise fundamental questions regarding contemporary social life, to foster reconsideration of that which is taken for granted and thereby furnish new alternatives for social actions*. Avital and Te'eni (2009) elaborates on this definition and defines generative capacity as: *comprising the ability to rejuvenate, to produce new configurations and possibilities, to reframe the way we see and understand the world and to challenge the normative status quo in a particular task-driven context*. This definition of generative capacity appears to be a central aspect of the behavioral capacity necessary for ambidexterity.

Based on the theoretical constructs of improvement trajectories, single and double loop learning, and generative capacity, a theoretical model was developed to explain the relationship between improvement activities and their exploitative or explorative character, see Figure 3.

The figure shows how single loop learning involves adjusting the action strategy without changing the governing variables. The figure also shows how double loop learning involves adjusting the governing variables and that this can happen in two ways, either as exploitation or exploration. The exploitative double loop learning adjusts the governing variables within the existing improvement trajectory, that is, the existing mental model for valid problems and solutions (as defined by Dosi, 1982). This means that the governing variables are part of a paradigm with norms for how improvement should be in the future, i.e., path dependence. The reason for this path dependent trajectory is an investment in specific mental models that create psychological biases toward some solutions (explaining mechanisms are described by Ahn and Bailensen,

1996; Ahn and Kalish, 2000). The improvement trajectory is illustrated in the figure as a broad arrow pointing the paradigms in a particular direction. The exploitative double loop learning is focused on getting the most value out of the existing governing variable components and architecture.

On the contrary, the explorative double loop learning challenges the existing improvement trajectory by questioning whether the paradigm contains the right governing variables. This process allows for paradigm adjustment, for example by introducing new governing variables or excluding old governing paradigms. This shift to a new trajectory is illustrated on the figure by the broad arrow that points the paradigm in a new direction. The explorative double loop learning is an example generative learning that requires generative capacity, the ability to challenge the normative status quo in a particular task-driven context to produce new opportunities for action.

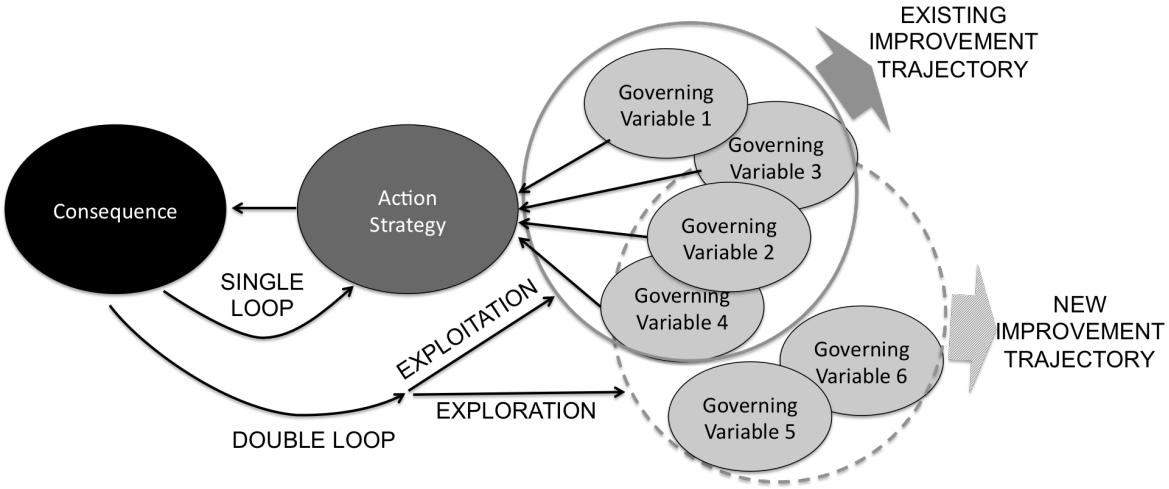

Figure 3. Three different learning processes and their mechanisms.

These explanations describe the three different learning processes. The learning processes have advantages and disadvantages and should be used for different purposes. The effect of these different improvement types is illustrated by the s-curve metaphor in Figure 4. The figure illustrates that the new vocabulary provides a deeper understanding that highlights that the improvement trajectories consist of a series of sub-s-curves. The figure also shows how single loop learning means improvement within one sub-S-curve, double loop exploitation means moving to a new sub-S-curve, and double loop exploration means shifting to a new improvement trajectory.

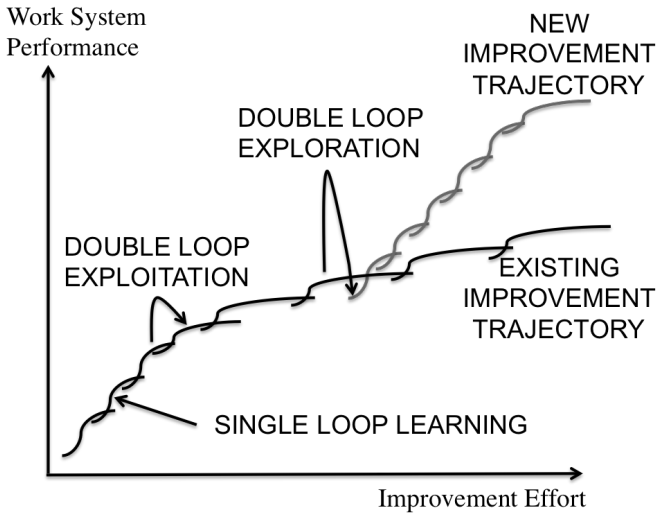

Figure 4. The learning processes impact described with S-curves.

Figure 4 demonstrates that all three improvement processes are necessary in order to be successful with improvements over time. The illustration highlights the importance of a capability for using the right process at the right time. However, the illustration does not show how to achieve this. Based on these new insights, another look at the empirical material can clarify what mechanisms lead to trajectory shifts.

6.3 What mechanisms lead to trajectory shifts?

The analysis found three cases of exploration and seven cases of exploitation. Based on the qualitative data coding the three exploration cases analyzed in order to investigate how the trajectory shift took place.

The three cases that shifted trajectories had one thing in common: They all used the improvement steps affirmative topic, success factor analysis, and future state visualization. By analyzing the three cases some similarities were found that differed from the other seven cases. First, the affirmative topic in the three exploration cases changed the apparent challenges. In the three cases, the reformulation into an affirmative topic not only changed the original problem understanding, but the reformulation created a new mental model with new assumptions about relevant problems and valid solutions.

Second, the exploration cases created a new language for talking about the challenge. During the subsequent success factor analysis this new language was reinforced with a new filter through the study of past success experiences. Since the success factor analysis was aimed at collecting information about the new affirmative topic, the step also reinforced the new mental model by collecting stories arguing that the challenge was possible to solve, thereby lowering the participants' barriers.

Third, when the future state visualization was carried out, the new mental model, the new language, and the success factor stories enabled open discussions that challenged the normative status quo in the particular task-driven context, i.e. displaying a generative capacity as defined by Avital and Te'eni (2009). In this way, a trajectory shift took place.

Case 8 provides a practical example of simple exploration in action. The case originated in a problem regarding decreasing efficiency of the maintenance and cleaning of equipment. To begin, the task of "optimizing cleaning time" was reframed in the project group into an affirmative topic: "How can we achieve world class efficiency?

What would we do as role models if Toyota came to visit us?" This change of perspectives made the team realize that world class efficiency was not only about sub-optimizing the cleaning process, but could involve re-thinking the concept of weekly cleaning. When the team moved into the success factor investigation they investigated past experiences about world class efficiency, for example rapid change over, one-piece flow, and coordination between activities. This step reinforced the legitimacy of the affirmative topic, the new mental model, and the new language. During the future state visualization step a new ideal turned up: "We operate without stopping the machine for cleaning." This future state demonstrated a shift in mental models. The outcome of the case was that the team not simply optimized the cleaning process but instead designed new norms for organizing cleaning, which now took place like a formula one pit stop planned when the machine had to stop for other reasons. The result was a removal of the routine cleaning stops, which meant improved efficiency.

The example shows the three mechanisms that create the difference between exploitation and exploration, i.e., the trajectory shift:

1) Reformulation into an affirmative topic creates a new mental model with new assumptions and a new language, i.e., a precursor for a new trajectory.
2) Collective investigation of success factors reinforces the new assumptions and language and creates consensus on future state characteristics.
3) Formulation of a desired future state matching the affirmative topic's mental model creates a new solution space that allows the improvement activity to change trajectories.

The key to trajectory shifts is the reframing of challenges that creates new mental models. While it may seem counterintuitive that investigation of existing success factors leads to exploration, the qualitative study suggests the explanation found in its combination with the new mental model initiated by the affirmative topic.

It should be noted that the proposed three mechanisms also explain how the Toyota improvement approach can lead to ambidexterity. Many improvement activities will not have an affirmative topic and will thus be exploiting activities, but once in a while they will pose really tough and almost impossible challenges that require a reformulation into an affirmative topic, e.g., the development of the Prius car as described by Liker (2004).

6.4 What are the barriers to trajectory shifts?

Analysis of the other seven cases revealed a number of barriers for creating trajectory shift. First, the cases 1-3 showed that the root cause analysis step reinforced the existing improvement trajectory by using normative arguments disguised as rational logics (as described by Ahn and Kalish, 2000). Take case 1 as an example: In a machine breakdown due to a human operating mistake the root cause analysis identified the training system or the human-machine interface as the root cause. This result of the root cause analysis is based on the underlying argument that another design of either the training system or the human-machine interface could have avoided the problem. However, the conclusion that the event was caused by the failure of a specific system's design is a normative argumentation based on assumptions within the existing improvement trajectory. This type of logic thus reinforces an exploitative improvement even though it leads to double loop learning. Consequently, root cause analysis reinforces the existing improvement trajectory and leads to exploitation.

Case 4 represents another barrier: Without an affirmative topic choice for pointing in a new direction no trajectory shift will happen. In case 4, new knowledge and improvement was created during success factor analysis but mental models stayed the

same. Cases 5 and 6 illustrate yet another barrier to trajectory shifts: No future state visualization. Even with an affirmative topic and success factor analysis, if there is no future state visualization the solution space will remain within the existing improvement trajectory.

A fourth barrier can be concluded from comparing cases 9 and 10 that followed the same improvement steps but where one was exploration and the other exploitation. Thus, using specific improvement steps is no guarantee for leading to a particular improvement type. The qualitative analysis suggests the reason to be difference in facilitation, e.g., different emphasis on the phases and different question technique. This sums up to four barriers to exploration:

1) Normative logics. Root cause analysis reinforces the existing trajectory by attributing cause-and-effect relationships based on normative logics.
2) No new direction. Without an affirmative topic choice the old new mental will sustain the improvement activity within the existing trajectory.
3) No future state. Without a future state visualization the solution space of the improvement activities will sustain within the existing trajectory despite the affirmative topic choice and a success factor analysis.
4) Facilitation. The steps alone are not adequate, good facilitation is a required improvement leadership skill.

7. Conclusion

This paper investigates whether contextual ambidexterity can be created through improvement leadership. The case study shows that different improvement leadership approaches can co-exist within one organizational entity. The study also shows that different improvement leadership approaches lead to different types of improvement activities. The problem solving approach primarily leads to exploitative activities, and the strength-based approach primarily leads to explorative activities. By developing a behavioral capacity in leaders to decide when to use what improvement approach, contextual ambidexterity can be achieved. This behavioral capacity can either be based on shifting between different improvement leadership approaches, or by using a dynamic improvement approach, e.g., Toyota's problem solving approach.

The paper uses the empirical material to analyze the mechanisms that lead to exploration and exploitation, and presents a model for understanding contextual ambidexterity in relation to the improvement leadership approach. The model shows how exploration can incrementally change the improvement trajectories of work systems and thereby over time lead to radically improved performance.

Further research is encouraged to challenge the findings in new contexts. Also, the unit of analysis of this paper was the improvement leadership approach. Since one finding was that the role of facilitation made an impact, further research is encouraged using the skills of leaders as unit of analysis.

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Appendix B – Other Dissemination Activities

The research project was disseminated through presentations, projects, and other written material, on top of the three research papers. In the following lists of the presentations, projects, and other written material will be presented. The written material is attached after the lists.

A. Dissemination through Presentations

Table 6 shows a summary of presentations for research dissemination.

Table 6. List of presentations

Theme	Audience	# Participants	Date
Strength-based Lean	Novo Nordisk DMS Man	19	Jan/11
Strength-based Lean	Novo Nordisk DMS Production Man	8	Jan/11
Leadership and Team Dynamics	Ferring	30	May/11
Strength-based Improvement	PS@Shopfloor project group	5	Sep/11
PS@Shopfloor Kick Off Workshop	PS@Shopfloor participants	15	Sep/11
Strength-based Lean	Resonans Inspiration Meeting	30	Sep/11
Strength-based Lean	AI Forum Östersund	40	Oct/11
Strength-based Lean	FOA	4	Oct/11
Strength-based Lean	Arbejdsmiljøkonferencen	30	Oct/11
Strength-based Lean	Haldor Topsøe	3	Nov/11
Strength-based Lean	Novo Nordisk, Chartres HR Managers	3	Nov/11
Strength-based Leadership	Academy, Paris	20	Nov/11
Strength-based Lean	Novo Nordisk, Production directors network	4	Dec/11
Strength-based Lean	Novo Nordisk DRD Lean consultants	2	Dec/11
Strength-based Lean	Novo Nordisk DRD Man	10	Dec/11
Strength-based Lean	Dansac	15	Jan/12
Strength-based Lean	TDC 2.0 Lean change agents	20	Feb/12
Problem solving and work systems	Novo Nordisk, PDI Man	8	Mar/12

Appreciative Leadership	IDA IT	30	Mar/12
Strength-based Lean	Flügger, HR Manager & Lean Manager	2	Apr/12
Strength-based Lean	Workshop at World Appreciative Inquiry Conference	40	Apr/12
Strength-based Lean	Presentation at World Appreciative Inquiry Conference	30	Apr/12
Strength-based Lean	Radio Interview at World Appreciative Inquiry Conference	100	Apr/12
Strength-based Lean	Berlingske	20	May/12
Strength-based Lean	Open Workshop in Göteborg	10	May/12
Improvement Leadership	DTU Operations Management Forum	40	Jun/12
Appreciative Inquiry and project highlights	Colas	5	Jun/12
Strength-based Lean	Berlingske	15	Nov/12
Strength-based Lean	Resonans Inspiration Meeting	30	May/13
Strength-based Lean	Workshop at Academy of Management Conference	50	Aug/13
Strength-based Lean	Presentation for University of Benedictine PhD candidates	30	Aug/13
Improvement Strategy	Dansac	22	Sep/13
Strength-based Lean	Teknologisk Institut Lean Conference	25	Sep/13
Engineering Leadership	IDA Management Conference	100	Sep/13
Strength-based Lean	NAV, Oslo	8	Oct/13
Strength-based Lean	EVRY, Oslo	2	Oct /13
Strength-based Lean	Grundfos	7	Oct/13
Strength-based project management	NRK	25	Nov/13
Strategic Dynamic Capabilities	Novo Nordisk DMS	300	Nov/13
Strength-based Lean Coaching	Novo Nordisk NMS	10	Jan/14
Strength-based Lean	Thermo Fisher Scientific	5	Jan/14
	TOTAL # Participants	**1145**	

B. Dissemination through projects

During the time project period, I carried out a number of consultancy projects to disseminate my findings and knowledge. Key projects are summarized in Table 7.

Table 7. Key consulting projects.

Project Aim and Approach	Participants	Time Period
Aim: Continuous action research at the case organization. Approach: Participation in management meetings, responsible for various projects, presentations and dialogue sessions during the project period.	Novo Nordisk DMS Production. Continuous dialogue with 10 managers in the department and contact with the 80 employees in the department.	Jan/11 – Nov/13
Aim: Quality improvement and coaching of project teams, as well as quality data collection. Approach: Coaching during last four months of the planning phase and daily coaching during the execution phase as well as conflict management.	World Scout Jamboree 2011. Quality improvement and coaching of 5 teams with 25 members in each. Part of management team with responsibility for activities for 25.000 participants for eight hours per day for six days.	May/11 – Aug/11
Aim: Employee engagement in new strategy implementation. Approach: Design and facilitation of three planning workshops and two one-day large-scale summits. The summits involved high adrenaline games in a space mission setting.	Copenhagen Airports, Asset Management and Cleaning Department. Planning workshop with 25 participants. Two one-day summits with 150 participants each day.	Nov/11 – Dec/11
Aim: New definition of leadership for the scout movement and research on leadership development in the movement across continents. Approach: Data collection through workshops in Hong Kong and Berlin and interviews with key people from five continents. Development of new leadership definition at workshop series in Helsinki and New York.	World Organization of the Scout Movement. Key informants from 5 continents and an international project team from 3 continents.	Apr/12 – Apr/14
Aim: Formulation of an improvement strategy. Approach: Facilitation of a one-day workshop with management group.	Dansac. 20 managers.	Nov/13
Aim: Development of a new project management standard for the organization's largest projects and training of senior project managers. Approach: Design of a one-year master class series for development of the standard. Facilitation of a two-day workshop for training senior project managers in Strength-based Lean.	NRK (Norwegian national broadcasting). 25 senior project managers.	Nov/13
Aim: Formulation of a new strategic vision and facilitation of a large-scale summit for engaging all employees in the new vision. Approach: Facilitation of a series of workshops for 25 managers. Design and facilitation of a large-scale summit with 300 participants co-facilitated by the 25 managers.	Novo Nordisk DMS. Workshop series with 25 managers and a summit day with 300 participants.	Oct/13 – Dec/13

C. Dissemination through other written material

A summary of other written material for disseminating the research results can be found in Table 8.

Table 8. Other written material.

Title	Media	Publication
Strength-based Lean as a Leadership Approach	in Shaked, D. (2013), *Strength-Based Lean Six Sigma – Building Positive and Encouraging Business Improvement,* pp. 207-216, KoganPage, ISBN: 9780749469504	Nov/13
Appreciative Problem Solving	in Paper Submissions Binder, 2012 World Appreciative Inquiry Conference	May/12
Work System Innovation: Designing Improvement Methods for Generative Capability	in Paper Submissions binder, 2013 European Operations Management Association's Conference	Jun/13
Enabling Continuous Work System Innovation – the key mechanisms for generativity	Poster presented at the 3rd World Congress on Positive Psychology	Jun/13
Der behøver ikke være så meget spild i Lean	Published in Ledelse i Dag	Apr/13
Hvad er jeres forbedringsstrategi?	Published in Børsens Ledelseshåndbog for Strategi og Ledelse	Jan/14
Mellemledelse i forbedringskultur – snubler jeres Lean-indsats i ledernes tre faldgruber?	Published in Effektivitet	Dec/13
Lean som fedtsugning eller styrketræning	Published in Ledelse i Udvikling	Nov/13
Dårlig kultur æder Lean-værktøjer til morgenmad	Published in Metal Supply DK	Sep/13

resonans

Strength-based Lean as a Leadership Approach

MS.Eng., PhD Candidate, David Hansen, Resonans and DTU Management Engineering, Technical University of Denmark. E-mail: dh@resonans.dk.

Published in David Shaked (2013), Strength-Based Lean Six Sigma - building positive and encouraging business improvement, pp. 207-216, KoganPage, ISBN 9780749469504.

'Imagine if my employees did what I told them to do…
That would be the worst thing that could happen!'
– Bo, Production Director,
medium-sized Danish manufacturing facility

Having visited many organizations that work with continuous improvement, I have seen distinctively different versions of Lean leadership implemented. Sometimes the task of creating long-term employee commitment to continuous improvement is shadowed by focusing on short-term goals. In other places, I was struck by a clearly energized dedication toward long-term commitment where everyone took responsibility for 'striding for excellence'.

From 2011 until 2013 I have followed and researched the daily management practices at a medium-sized Danish manufacturing facility exhibiting such energized dedication. As the introductory quote from their production director shows, management clearly believes in initiative and in engaging the strengths of their employees. At the same time, they are committed to Lean manufacturing throughout all of their operations. They use their unique strength-based approach to Lean Six Sigma to handle daily challenges in operations management. By focusing on strengths, establishing a generative environment, and using affirmative future images together with Lean manufacturing philosophy they have taken a significant step toward building sustainable excellence in their operations. The following stories highlight some of their best applications and the outcomes they were able to generate.

Challenge 1: Engaging people's best strengths at work

Do some people have a repertoire of strengths that they just don't bring to work? Could engaging these strengths lead to unexpected but crucial success?

One morning I met with three machine operators from the company. They told me, 'Years ago, we decided we wanted to retire in this company - that meant we needed to take more responsibility - we needed to help the company stay competitive and significantly increase its productivity.' They knew some ideas had to come directly

from the knowledge at shop floor level. The managers wouldn't be able to achieve this on their own.

That day, the machine operators were on their way to present their daring ideas for crucial changes to a scheduling system in front of 30 managers. The change would affect the entire planning system for scheduling how many machine operators had to work and when. For years, management had focused on small efficiency improvements but largely ignored the potential in questioning the scheduling of operators' working hours. The operators' idea for a new planning system would allow the factory to operate with 20 % less people provided they would accept a more flexible schedule. In their view this was a crucial improvement in order to keep the facility competitive. 'We need to be cheaper than our American sister facility. I want to show how competitive we can be as a production plant in Denmark so that perhaps more production is transferred here.' The other operator continued, 'Obviously, it is not popular to say that we have too many operators. We may lose jobs. Some may say that we will eliminate 20 % of the jobs but we would argue that we will save 80 % of them and it is necessary in order to help the factory survive.' Their Kaizen contributions were clearly not limited to just small daily operational improvements but also focused on changing the larger systems.

We arrived at the conference room. The 30 managers were ready and curious. The three guys were getting nervous. One told me, 'I really don't like presenting. If I could just do my job I would prefer that. But I want to do this to help us survive.'

The managers were impressed by the new ideas and by the shop floor employees' dedication. Some were sceptical, 'Great idea, but what would the union say?'…'Can it work in practice?'…'It'll be too hard to implement!'

We left the room and the operators calmed down… 'Do you think they want to try it?'

'I don't know… I think they got an alternative view, and that is good.'

Six months later, the struggle to improve the system bore fruit. The planning system was first tested in one part of (and later in the entire) facility. It required extensive negotiations with the union, but in the end it led to both savings and also better working conditions, according to the remaining operators, as they now had better options for improving the work processes.

This story exemplifies how some people have unexpected strengths that aren't often used at work. Why did these shop floor workers get engaged in large scale improvements that went beyond their defined job responsibilities? What motivated them? I asked them and the answers were interesting:

'I just want to do my job and whatever I can to contribute… But I don't want to be a manager.'; 'I like to see that I have been a part of creating something.'; 'I like working with different people. I want to be part of the best team or the best factory. I like to be part of something bigger.'

They all wanted to contribute to the bigger picture. They didn't want to just do what they were told: they wanted to use their brains at work.

One of the most important challenges for managers of daily operations in any organization is how to bring the strengths of everyone into the game. Jack Welch was asked about the most important leadership challenge for the 21st century and his answer was simple: 'To bring every mind into the game!'

Only when we engage everyone's strengths can a true improvement culture be sustained: when machine operators see the need to change the larger systems and get engaged with it rather than expect management to solve it.

One of the operators summarized the most important foundation for their engagement, 'When we accepted that the managers were the best at leading and organizing the work… And when they accepted that we were the best at operating the machines… When we accepted each others' strengths, we were able to shift the situation.'

As a contrast, in another company, I met a technician who always did a good professional job but rarely anything beyond what was expected of him. One day his manager heard that he was running for mayor in the local city, and that he was really good at mobilizing people for a higher cause. The manager realized that this strength had never showed up at work; it was hidden in his private life. This is an example for the huge potential that often remains unrealized because personal strengths have not been identified and activated at work.

To conclude the story, the core of taking a strength-based approach to Lean leadership is in finding ways to access and build on people's most useful strengths - even the unexpected ones. As Marcus Buckingham puts it: *Average managers play checkers, while great managers play chess*. They see that every piece is different, with different strengths, and use this tactically. There is a huge hidden potential in doing so. What can you do to engage more of your colleagues' strengths at work?

Challenge 2: Engaging everyone in improvements

Who should be engaged in improvements in order to have an improvement culture? Can we really get everyone engaged? Who are the best experts with the best solutions? How can we access their knowledge? How can we engage everyone's knowledge to strengthen the improvement culture?

These questions often come up during continuous improvement initiatives that hope to establish an improvement culture. Often, the technical systems for creating improvements get implemented (such as idea banks and improvement meetings) but after a while people are no longer engaged in improvements. A true improvement culture is missing, a culture where the status quo can be regularly challenged, safely.

In the following example, the production management team handled a strategic change in the factory by accessing and engaging the collective knowledge of the whole system to find the best solution for a significant and pressing operational challenge.

One morning, the production director received a new production forecast that was substantially different from the one the plant was currently following. A former product

had to be insourced back to the factory and produced in parallel with the existing, newer product. Since the entire factory had been optimized for one product, this posed complex challenges. The team leaders and production manager held a meeting to agree on how to handle the change. A project manager had already been assigned at the corporate level to help handle the process, and several internal Lean consultants were also available. So, how should they proceed with the change?

During the meeting, the production director and the team leaders decided they wanted to kick off with a focus on two things:

1. Establishing a shared affirmative future image for the change and,
2. Engaging everyone, not just the experts, in identifying and creating the necessary improvements.

They planned to start with a one-day summit, with the entire production department in the room in order to engage everyone's strengths in getting the best out of the new situation. Some think that it's expensive or impossible to close down production for a day, but the production director argued that 'every successful sports team takes time out when they need sudden changes, and it's always worth it.'

The day started with the production director talking about the new situation. He framed his presentation carefully in order to highlight future possibilities in the situation and thereby allow for ideas to emerge, rather than making everyone nervous about the future and thus adopting a defensive posture, which could have been the case with a 'burning platform' story. Instead, he highlighted the opportunity to show their ability to create improvements and therefore position the plant well in the global competition for the next product launch. After some time discussing the future image, the participants agreed to this overall direction.

The next phase was to identify each of the teams' strengths and assess which strengths would be most useful in achieving success. It was carried out in three steps:

1. Using paired interviews where everyone was asked to identify the strengths of the team through sharing an experience of peak performance;
2. Sharing the best stories with everyone to get inspired; and
3. Selecting the three most important team strengths for the entire department to hear.

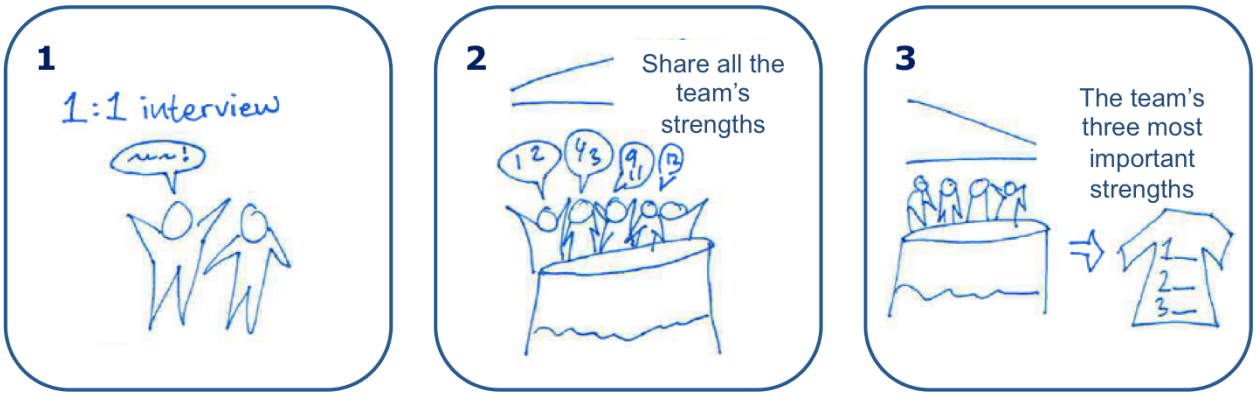


Figure 17.2: The three steps taken to identify the team's most important strengths.

Observing this process, I could see how connections between people were established when they interviewed each other, and how they became more energized. It was even more interesting when the teams had to select and agree on three strengths. One team of technicians started with a somewhat sceptical attitude; most sat with their arms crossed. Gradually, as the task progressed, the atmosphere changed. It was great to see these competitive guys trying to convince the others that one particular strength would be more useful than another. Not only did they end up with a list of three strengths to present to the rest of the department, they had also convinced themselves they actually had the necessary resources to succeed with the challenge. This phase culminated in plenary presentations where all teams shared the strengths they wanted to use to achieve success.

The final phase focused on collecting ideas and knowledge from all teams on how to realize the affirmative future image. They were asked three guiding questions:

1. What are the necessary improvements in order to achieve success?
2. What do we already know we want to do as a team?
3. What improvements require support from others in order to be able to realize them?

Figure 17.3: The three steps taken to generate input about improvements necessary to achieve success.

Note the distinction between asking for input to solve a future problem vs. identifying what should be done to achieve an affirmative future image. Since the change in this case focused on insourcing a product - a task that many of the participants had successful past experiences with, the question allowed for both a critical perspective of what needed to be done and a more generative perspective of what could be done to exceed the expectations and past achievements. The teams' process facilitators were aware of this distinction and made sure both perspectives were considered in the discussions. After an hour the teams presented their ideas and all had a chance to comment and applaud the presentations. The inputs were collected and passed on to the new project manager, but each of the teams took responsibility for their own three suggestions. During lunch some of the ideas were already moving forward. At

the end of this four-hour off-site session, no one had their arms crossed: most people were standing around the whiteboard engaged in lively discussions.

So, what were the outcomes? Twenty-two executable ideas were fed to the project manager, and 24 actions were adopted by the team. The most important improvements that started during the day were a new idea for in-process quality control and an idea on how to increase flexibility and support between the different teams when cross-functional effort was needed.

The indirect outcomes may have been even more important for the success of the change. One of the participants mentioned in an online evaluation that 'it is important that everyone feels they are a part of the decisions that are made. It's great we've been asked because now it is much easier to implement the changes.' What a great testament to the high level of engagement achieved by taking this approach!

Having everybody in the room at the same time also gives opportunities for quick changes because decision makers are available. Common excuses for inaction (eg management or other teams will not allow an idea) can be instantly tested to allow the idea to develop instead of be eliminated without reason.

A change activity like this is strength-based for two reasons. First, it focuses on getting all the strengths in the entire department engaged by involving everyone. Second, its focus is on realizing an affirmative future image, instead of trying to avoid the effects of a problematic external force. Positive future images have two purposes: to elevate the strengths in the organization by aligning efforts and creating a shared sense of confidence; and to enable a change of thinking paradigm and the emergence of optional solutions.

The production director made three points at the start of the day:

1. Our shared input is important for success;
2. Our subsequent engagement is crucial; and
3. We need to identify and mobilize our strengths.

This belief in the power of getting everyone involved from the start and establishing a clear shared image of the desired future helps make it meaningful to everyone in the factory and empowers them to execute improvements. What an excellent way to cultivate an improvement culture!

Challenge 3: Managing daily improvement activities from a strength-based perspective

What about daily improvements? Should Strength-based Lean focus on solving problems or on identifying and elevating success?

Finding the answer to this question had been a puzzle for the managers in the production facility for some time. The facility had a well-developed performance measurement system in place and therefore data about efficiency levels was available on a daily basis. This can lead to quick identification of problems and a focus on solving them.

But was this actually an issue in this case? According to the production director, it was. They needed to actively work with this habit, because as he said, 'When the

core of our work processes lies in technical problem solving, it is easy to fall back to a deficit-focused mindset that does not foster effective collaboration.' He concluded that while problem solving is a necessary part of the everyday management at an effective production facility, it is also necessary to actively find ways to balance the problem focus with a more engaging mindset in order to sustain the desired collaborative improvement culture.

Management at the facility realized that this had to be integrated with everyday actions in order to influence the culture. They therefore implemented three strength-based practices:

1. **Learning from and reinforcing positive deviances in performance.** This is carried out systematically and handled just as if it was a problem to solve. Following a template with specially crafted questions designed to identify the root causes for the success, people get assigned to the task of understanding, learning from and reinforcing a positive performance deviance, such as a record high efficiency for a week or an example of a successful project carried out in a team. Although this practice may seem simple, it can be challenging to isolate root causes for success, and often the answers given are generic and high-level factors such as good planning, coordination and professional work. However, surprising findings sometimes come out of the analysis, and even trivial responses such as 'good planning' can be an occasion to reinforce practices that might otherwise be forgotten. As one internal Lean consultant explained, 'I had tried to tell the team for months that they should spend a longer time in the planning phase before they went into doing. They never took my advice seriously. Now, after exploring their recent great validation, they concluded that the validations were effective because of good planning. Now they finally got it!' Another advantage about learning from positive deviances is that it usually leads to a focus on the entire work system rather than small technical issues which are taken out of context. It is necessary to build up a systems perspective to really create a sustainable improvement culture.
2. **Strength-based process confirmation.** The team leaders spend a substantial amount of time at the shop floor where they ensure team members follow the work standards. They had been looking for gaps between standard and observed actions in order to correct them. Now they have changed their perspectives. Now, they enter the shop floor with the assumption that team members are likely to have a good reason when they choose to take a different action. Often they end up improving the work process from the latest standard based on their individual strengths. This has led to very different conversations between team leaders and operators. Because team leaders actively look for positive actions, they create more constructive conversations that result in ideas for updates to the standard work procedures. Most importantly, though, is the change in atmosphere - the employees testify that they feel more involved - this of course reinforces the desired culture. Sometimes, they discover surprising findings! For example, they realized that one of the operators could manage the production halls while the other three were at lunch. When asked how he could manage the work of four people, he shared many good

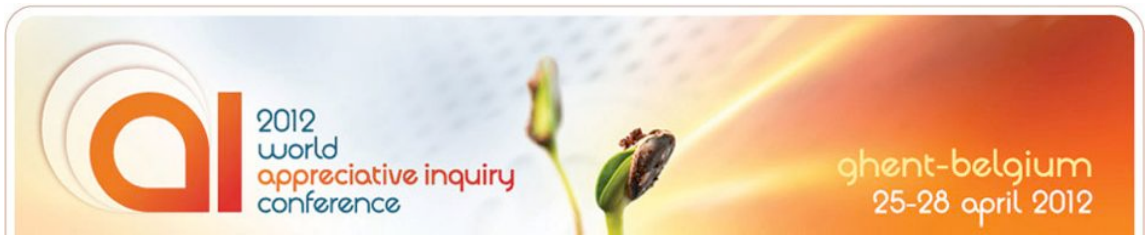
practices he had never shared before. This shows the power of active leadership asking ‘different questions’.

3. **A positive work environment with more fun** The final practice that enables improvement activities to be driven from a strength-based approach is a serious approach to creating a positive work environment with more fun. This continuous task is referred to as ‘funny business’. Almost every month, as well as spontaneously, an event is carried out simply for the purpose of creating a fun and positive environment at work. These events generate positive emotions and energy to feed on. For example, a group of samba dancers touring the facility; big ‘Where’s Waldo’ cardboard figures with inspiring questions hidden around the factory; and funny videos shared at serious presentations. The value of creating fun and positive emotions at work has been well described in Barbara Fredrickson’s research on positive emotions. Incorporating these large ‘funny business’ events as well as small daily practices to generate positive emotions are other ways of reinforcing a creative and strength-focused improvement culture as part of daily management.

So what are the key themes I can see that work particularly well to enable a strength-based approach to Lean leadership?

The three challenges I described show strength-based practices to daily Lean leadership. They share four principles that could form the basis for future operations management:

1. **Engage people’s best strengths at work.** When everyone brings their best selves and their strengths to work, and when the work is adjusted to fit different preferences, better alignment and therefore high performance can be achieved.
2. **Create shared affirmative images of the future as a basis for improvements.** Affirmative images of the future can create a shared sense of meaning that encourages everyone to see possibilities and empowers them to create improvements.
3. **Learn from and reinforce positive deviances.** When management practices require problem-solving AND learning from as well as reinforcing positive deviances on a daily basis, a more innovative improvement culture is established, one that not only focuses on simple technical issues but the whole work system.
4. **Actively create and enhance positive emotions at work.** When a work system builds its culture based on generating positive relations, emotions and energy, it creates a safe environment for people. Creativity, initiative and passion can then thrive.



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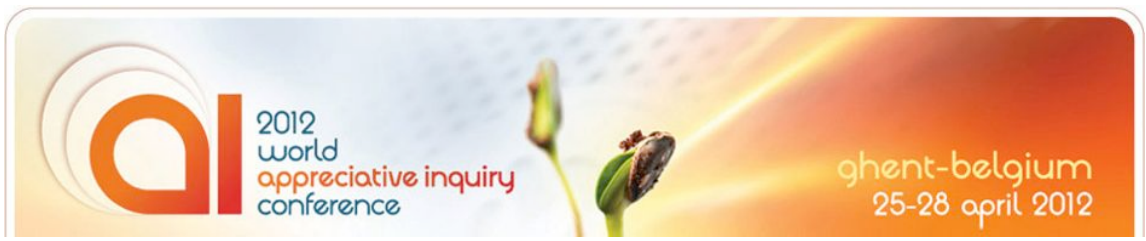

Appreciative Problem Solving

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Abstract
Many industrial production work systems have increased in complexity, and their new business models compete on innovation, rather than low cost. At a medical device production facility committed to Lean Production, a research project was carried out to use Appreciative Inquiry to better engage employee strengths in continuous improvements of the work system. The research question was: "How can Lean problem solving and Appreciative Inquiry be combined for optimized work system innovation?"
The research project was carried out as a co-creation process with close cooperation between researcher and participants and was documented by qualitative methods.
This paper presents an academic literature review on Appreciative Inquiry and problem solving for continuous improvements that did not reveal successful attempts in combining the two. Both the literature and the empirical study showed one of the main challenges to be to connect the two different thinking modes in the daily practice. The empirical study found both approaches useful for creating continuous improvements of the work system and identified different practices of combining them. From the empirical study, the paper identifies three approaches to work system innovation and discusses how Appreciative Inquiry, Problem Solving, and the combination 'Appreciative Problem Solving' can be used to optimize continuous work system innovation. These findings add to the theoretical foundation of the emerging field of Strength-based Lean.

Keywords: Appreciative Problem Solving, Appreciative Inquiry, Problem Solving, Strength-based Lean, Work System Innovation, Success Expansion.

The Emergence of Strength-based Lean Production

Industrial production work systems have been increasing in complexity for a long time (Wiendahl & Scholtissek, 1994), mainly due to increasing automation, need for specialized knowledge, and change frequency to fit new product development. In order to compete, some production facilities are using new business models that focus on their ability to create innovation rather than low cost for mass production (Johansen & Riis, 2005).

This study was initiated at the production facility Novo Nordisk Device Manufacturing and Sourcing that were 'ramping up' new production for medical devices. The business plan is based on the ability to create new work processes and get new equipment to operate while producing efficiently. This business plan implies a lot of technical problems and improvement challenges in the daily work. Novo Nordisk, which the facility is a part of has committed to Lean Production (Womack & Jones, 2003; Liker, 2004) and has worked intensely with this approach since 2003.

In 2005 the facility experienced a very high employee absence and low productivity. After being prompted by the surprising question "if your facility is an ultimate success in two years, how does it look?", the managers realized the problems were due to the employees' expectations and fear. They expected a closing down of the facility after phasing out their current product. The facility management then decided to initiate a project to create change by using an Appreciative Inquiry approach to engage the entire system in addressing the problem by turning it into a burning dream instead of a burning platform. They used a variant of the Appreciative Inquiry Summit (Ludema et al., 2003) to engage the whole facility in creating the dream of being 'most wanted as facility and employees' and starting up initiatives to achieve this dream. By using a strength-based approach they managed to turn around the situation and lower the absence with 50 %, raising productivity with 44 %, and cutting costs pr. product by 17 %. The ultimate success was realized when they succeeded in attracting a new product for production ramp up two years later (Kongsbak, 2010).

After having experienced Appreciative Inquiry successfully at the strategic level with the whole system, the factory management had a desire to make this approach useful in their daily operational work. The challenge was to combine it with Lean, which the company was committed to. The question was therefore: "How can strength-based approaches such as Appreciative Inquiry be integrated in the daily work processes in a company committed to the Lean production system?" This question lead to a multi-year research project on Strength-based Lean in collaboration between Novo Nordisk, the involved consultancy Resonans A/S, and the Technical University of Denmark.

The purpose of the project can be illustrated by a quote from the production director: "When technical problem solving for process improvement is in the core of our work processes it is easy to fall back to a deficit-focused mindset that does not foster effective collaboration." They wanted to create the collaborative engagement and creativity that they had experienced Appreciative Inquiry could create. At the same time, the Lean problem solving approach with root cause analysis was experienced as very valuable. They needed systematic problem solving to create the continuous improvements that were the foundation for the new product ramp up business plan at the facility. Systematic problem solving was a core strength they wanted to build on. The solution was therefore not to substitute it with Appreciative Inquiry but to find out how to incorporate both thinking ways into the daily work with problem solving and continuous improvements. This is where this research story begins.

A Desire to Bridge Two Paradigms

The challenge was that Appreciative Inquiry and Lean have quite different thinking processes, languages, and assumptions. But a look into their basic principles reveal that they are not contradictory, but rather address different things: The Appreciative Inquiry principles are change principles describing how to create positive change and the Lean principles are operation principles describing how an effective and efficient Lean work system should operate. The basic principles are summarized in table 1 (Cooperrider et al., 2008; Womack & Jones, 2003).

Table 1: Basic principles of Appreciative Inquiry and Lean.

Change principles	Operation principles
The constructionist principle	Create value for the customer
The simultaneity principle	Visualize the value stream
The poetic principle	Create flow in the value-creation
The anticipatory principle	Use pull from the customer
The positive principle	Seek perfection by continuous improvements

The challenge of combining the two is thereby not their basic principles, but rather the different assumptions and basic approaches. Examples of some differences are summarized in table 2 (inspired by Hansen & Shaked, 2012).

Table 2: Typical approaches in Appreciative Inquiry and Lean.

Approach to create…	Lean	Appreciative Inquiry
value for customer	Eliminate waste	Look for and grow value
efficiency and flow	Remove bottlenecks	Identify and expand best practice
effectiveness and quality	Reduce defects	Study and learn from perfection for the customer
continuous improvements	Identify problems, analyze root causes, and fix them	Identify best practices, explore success factors, and dream & design to improve

An example of the typical built-in assumptions in Lean is illustrated by Staats & Upton (2011) in a project of introducing Lean to knowledge work. After identifying a potential for improvements due to unproductive employees, the authors stated that the remedy for improvement was asking why-questions: *"Instead of assuming that the approach used for a process is right, assume that it's wrong. […] Why am I attending this meeting? Why am I filling out this report? Why am I standing at the printer?"* (Staats & Upton, 2011)

The example shows the typical implicit assumption in Lean behind improvement: To improve, you need to look for what is wrong, and then fix it. In Appreciative Inquiry the corresponding assumption would be: The first questions asked begin the change, so inquire into the best of what already is instead of analyzing causes of unwanted action, then, identify a positive vision to guide the improvement.

These, and other explicit and implicit assumptions that differ between Lean and Appreciative Inquiry makes it hard to identify how to approach the daily work when having a desire to use both thinking ways. Their approaches are different, but both can be effective in creating improvements and transformation (Bushe, 2005; Liker, 2004).

The field of Strength-based Lean is emerging from the potential in bridging the two paradigms, not just substituting one with the other. Since both approaches are based on creating change and learning, the topic for this study was chosen to be continuous

improvements (Barrett, 1995; Liker, 2004). While this topic represents difference in approaches, it could be a good opportunity to create a bridge at the conceptual level. Liker (2004) describes continuous improvement and learning by problem solving as one of four central themes in Lean. The research question was then formulated: "How can Lean problem solving and Appreciative Inquiry be combined and used for continuous improvements?"

The goal of the study was to understand how to combine the two in practice to give applicable advice to the production facility.

Two Different Improvement Approaches

The practical problem solving process in Lean is visualized by Liker (2004, pp. 256) as shown in figure 1. As the model shows, the approach is based on cause and effect investigation. The process can be simplified to three stages: Understand the concern (steps 1-3), investigate the root cause (step 4), and implement the countermeasure (steps 5-7). The visualization and metaphor for problem solving is a funnel of gradually narrowing the focus until the 'correct' cause is found, and then investigated by using why-questions. As step 7 states, a solution is not in place until it is standardized and confirmed by evaluation.

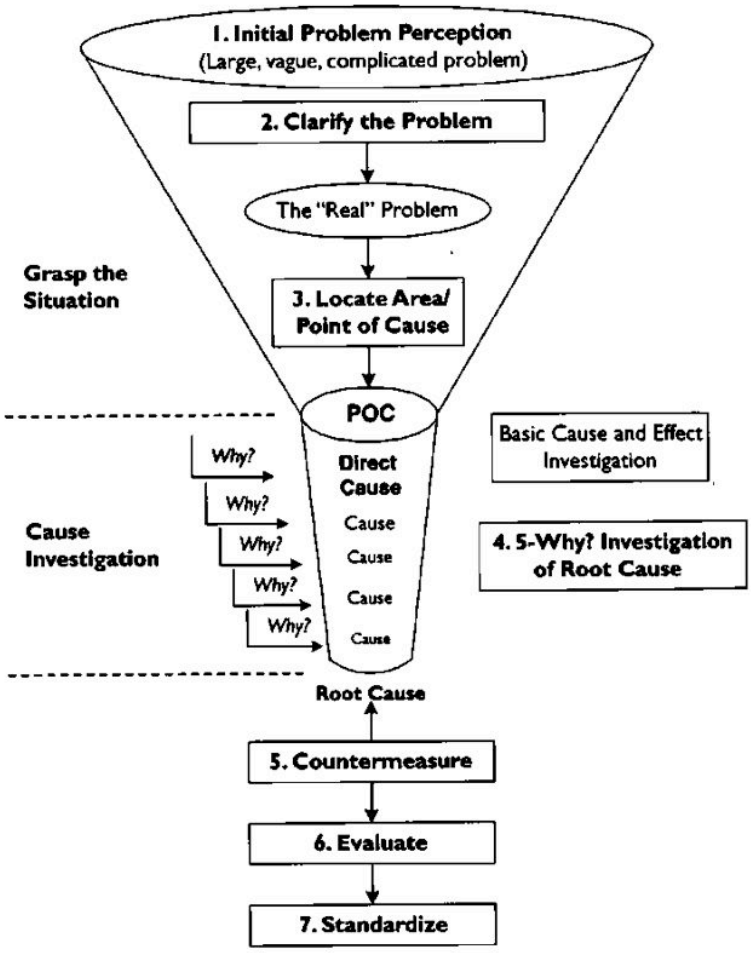

Figure 1: Lean practical problem solving process (Liker, 2004 pp. 256).

Continuous improvement is called *Kaizen* in the Japanese Lean terminology, and is either performed in Kaizen event workshops or directly at the shopfloor where daily problems are identified and problem solving used to create continuous improvements. In the Lean literature continuous improvement should create learning, both individual learning by self-reflection and organizational learning by involving stakeholders and building consensus during the process (Womack & Jones, 2003). Three central Lean keywords for problem solving are (Liker 2004):

- *Genchi Genbutsu:* Go and see the real thing in action to understand and act.
- *Nemawash*i: Make decisions slowly with consensus by involving stakeholders in considering options and rapid implementation.
- *Hansei:* Self-reflection on actions, spirit and attitude.

The concept of Japanese Hansei is described as a process where "*when you do something wrong, at first you must feel really, really sad. Then you must create a future plan to solve that problem and you must sincerely believe you will never make this type of mistake again.*" (Liker 2004, pp. 257). Lean problem solving is based on removing problems by rational investigating of the root cause, and in Japanese culture, sadness may be a necessary step for creating improvement and learning.

The process for creating change in Appreciative Inquiry is taking a different approach. It is based on the following five principles briefly introduced here (Cooperrider et al. 2005):

- **The constructionist principle** states that reality is socially constructed by multiple perceptions and inquiry into imagination is necessary to create change.
- **The simultaneity principle** states that the questions asked begins the change and inquiry cannot be isolated from implementation.
- **The poetic principle** states that organizations are continuously re-interpreted and re-constructed by the narratives told and what is given focus grows.
- **The anticipatory principle** states that actions are guided by images of the future.
- **The positive principle** states that positive thinking provides energy for creating change.

The Appreciative Inquiry approach to change is based on creating a momentum from the best of what already is and gives life, and by creating positive future images to move toward. The simultaneity principle implies that it may be more rewarding to ask for strengths in the system to build on instead of investigating root-causes of undesired action. The poetic principle argues that a chosen focus grow with the re-interpretation of the organization and it may therefore be more rewarding to re-interpret and strengthen the situations where the system is most alive instead of where it is least effective. The anticipatory principle states that guiding future state imaging are important in order to create effective action and change. These principles are conceptualized in the 4D model, a widely used process, as shown in figure 2 (Cooperrider, 2005, pp. 30). In some versions it includes a fifth D: Definition of an affirmative topic choice.

Appreciative Inquiry change is based on growing strengths by positive future images in a positive environment in order to create transformational change, and a positive environment is considered necessary.

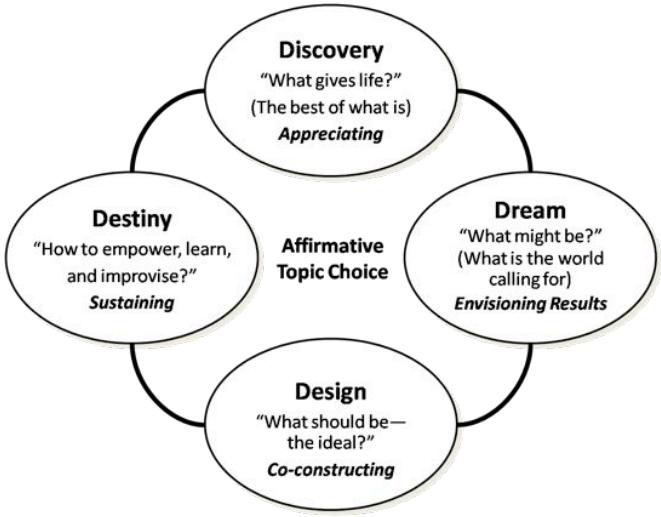

Figure 2: The 4D model of Appreciative Inquiry (Cooperrider, 2005 pp. 30).

Asking the Literature: How to Combine Lean Problem Solving and Appreciative Inquiry?

An academic literature review was then carried out to get input on how to combine the two approaches for continuous improvement by searching EBSCO Host Academic Search & Business Source Premier, and Thomson Reuters Web of Knowledge for conference proceedings and journal papers. The result is summarized in table 3. There were no hits on "Appreciative Inquiry" AND "Lean", "Operations Management" or "Production". Note that the literature review did not included books or practitioner journals, which could also have contained relevant material, but this was chosen in order to identify a research gap to address.

Table 3: Summary of Literature Search on Appreciative Inquiry and Lean Problem Solving.

Search Term	Total hits in the database	Papers concerned with discussion	Papers concerned with combining
"Appreciative Inquiry" AND "Lean"	0 hits	0 hits	0 hits
"Appreciative Inquiry" AND "Process Improvement"	10 hits	0 hits	3 hits
"Appreciative Inquiry" AND "Continuous Improvement"	4 hits	1 hits	2 hits
"Appreciative Inquiry" AND "Engineering"	6 hits	1 hits	1 hit
"Appreciative Inquiry" AND "Problem Solving"	31 hits	5 hits	0 hits
Total hits (no replicates):	**42 hits**	**6 hits**	**4 hits**

The majority of the papers that discussed the two approaches were critical towards problem solving and highlighted the strengths of Appreciative Inquiry, emphasizing that a problem

solving approach could lead to defensive posturing that discourage action and creative thinking (Barrett, 1995; Neilsen, 2005; Shendell-Falik et al., 2007), as well as inhibit knowledge generation in collaborative work (Phlypo, 2008). Appreciative Inquiry creates opportunities for innovation of processes and ways of working together as well as to create enthusiasm and commitment to the organization, while problem solving does not foster excitement, enthusiasm or generate innovation beyond the defined problem's parameters (Shendell-Falik et al., 2007). The latter is due to the nature of problem solving that starts from a defined problem space set by constraints and boundaries with the solution coming from within the alternatives of these limitations (Avital, 2005). Barrett (1995, pp. 37) adds: *"accepting the constraints that generated the problem rarely leads to a permanent solution; instead, it often leads to patterns of coping."* In contrast, Appreciative Inquiry uses affirmative reflection and positive affect to lift up the search for ideal possibilities where the most desired solution is picked (Avital, 2005).

Neilsen (2005) introduces another view; that there is nothing wrong with the problem solving approach per se. When at best, both approaches makes the participants experience themselves at their best while achieving the highest levels of collaboration. He argues that that change requires secure organizational attachment that is often not established with problem solving approaches. It is therefore not the process of doing Appreciative Inquiry but the initial interventions of creating mutual trust that is the key to successful change.

Barrett (1995) introduces how a learning perspective can illustrate the effect of Appreciative Inquiry, e.g. that groups using selective self-monitoring focusing on successful outcomes have higher performance. Barrett (1995) stresses the importance of generative learning and thinking outside the accepted limitations, and argues that Appreciative Inquiry creates better learning systems that possess affirmative competence (being able to appreciate positive possibilities and strengths), expansive competence (challenging old habits with higher ideals that inspire to action), and collaborative competence (ongoing dialogue with diverse perspectives).

This summarizes to three types of arguments of the value of Appreciative Inquiry in relation to problem solving:

- More enthusiasm and commitment to change.
- More generative learning systems.
- More creative thinking and a wider solution space.

The papers that were concerned with combining the two approaches were all arguing how to incorporate Appreciative Inquiry into an existing process or method. Ncube & Wasburn (2008) combines Appreciative Inquiry and a Needs Analysis Model in order to increase proactivity of continuous improvement. They state that the combination avoids an overly positive focus at the expense of shortcomings and underlying organizational problems. They argue about the necessity of understanding problem causes, but their case did not incorporate it into their combined concept. Cuyvers (2010) argues how Appreciative Inquiry could support continuous improvement of quality development by changing focus from control to development. He argues about the necessity for still using measurements and structured methods but does not share insights on how to integrate the suggestions into established processes such as the Deming cycle and problem solving. Baaz et al. (2010) describes the

combination of Appreciative Inquiry principles with an evaluation method of learning from both excellence and challenges. They show how optimal learning is normally inhibited by an over-focus on the challenges. But, by teaching strength-based principles and incorporating Appreciative Inquiry into the method, they could create workshops with better learning and broader suggestions for improvements. Their combined concept involved cause and effect analysis for both excellences and challenges, and they recommend keeping a balanced focus between the two. For example by letting participants recognize problems and discuss causes but encourage suggestions for improvements and by showing problem-oriented individuals their views will also be considered. Holmberg et al. (2009) describe the use of Appreciative Inquiry for software process improvement and show the difference in underlying assumptions behind improvement and learning compared to problem solving based process improvement such as the DMAIC and IDEAL models. They report difficulties in introducing an Appreciative Inquiry mindset to engineers who appreciate the challenge of solving problems, and found that engineers struggled with expressing themselves in appreciative terms and with exploring hopes and dreams collectively. They were less enthusiastic in the dream and design phases, and they usually easily enjoy the challenge of identifying and solving problems. Holmberg et al. (2009) conclude that the satisfaction of problem solving may impede the use of Appreciative Inquiry in similar environments, and they recommend acknowledging the strengths of problem solving before demonstrating the potential of using Appreciative Inquiry. These papers also highlight enthusiasm, learning, and a wider solution space as the most important contributions from Appreciative Inquiry.

While the papers contribute with recommendations and experience, they do not answer the question of how to combine Appreciative Inquiry with problem solving. This knowledge gap needed to be addressed in the research project. The research question should be answered by developing a combined concept. Because of active engagement from the people at the production facility, a co-creation process was undertaken. By engaging the participants as much as possible in conceptual discussions and by engaging the researcher as much as possible in practical participation, it was hoped that the concept would get the best input from both theory and practice. This also meant using an abductive research approach.

Identifying the Potential of Appreciative Problem Solving

Before the development of an appreciative problem solving concept was initiated, an inquiry into the possible potential and attributes was carried out to identify its focus. The research question had emerged from a desire at the facility, and that initial attraction was used as the foundation for a workshop to identify the potential of incorporating Appreciative Inquiry into Lean problem solving practices. A condensate of the answers is summarized in table 3.

They show that the concept could potentially address different levels of problem solving:

- The input and environment: Engage more strengths at work & engagement in goals.
- The process itself: More mental energy & better solution process.
- The outcomes: More learning & drive of the desired culture.

This corresponds quite well with to the three categories found in the literature review of enthusiasm, learning and wider solution space.

Table 3: Identifying the potential of introducing Appreciative Inquiry to Lean problem solving.

Category	Potential stated at the workshop
Engage strengths better at the work place	• Engage people's strengths to bring more competencies into the work place • More life and energy • Better match between competencies and goals
Create more mental energy & resources	• Get people more engaged • Improve trust and cooperation (social capital) • By creating a space for playfulness • Turns short term result focus into long term result focus • Fun to do what you are good at • By more appreciation of what works well
More learning	• Learn from positive deviations & success • People improve more when they have fun • Better understanding by systematic learning of what already works • Enables learning instead of blame and defensiveness
Better solution process to create improvements	• More creativity and a larger solution space • Synergy between people in the problem solving • More people get engaged in the process • More proactive solutions • Enables a focus on attractive quality not just 'need to have'
Engage in the goal, not the task	• Structure for more empowerment • By visionary leadership • Meaningful goals create more engagement • Makes people bring their ideas and solutions • People stretch more when they want to reach goals
Drives the desired culture	• Use different questions to drive culture and a new focus • Drive a more engaged and cooperative culture

The identified potential in combining Appreciative Inquiry and problem solving is visualized in figure 3. The identified potential shows that there could be different focus areas to choose to expand for the development of a combined concept.

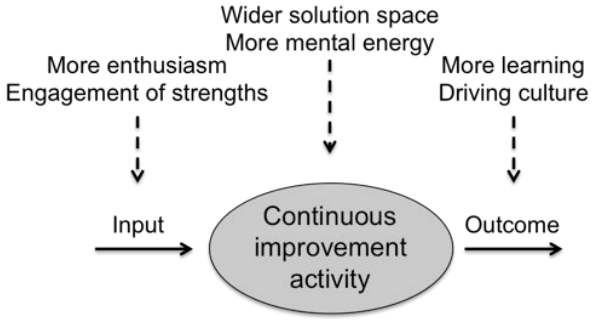

Figure 3: Identified potential of combining Appreciative Inquiry and problem solving.

In order to get insights that could contribute to the bridging, it was decided to get into the core difference between Lean problem solving and Appreciative Inquiry, namely the process and approach to improvement itself, with their different problem and solution spaces.

A continuous improvement activity can result in two types of learning. The first is adaptive learning of response and coping with environmental demands in order to make incremental improvements (Barrett, 1995), similar to what Argyris (2002) calls single loop learning. The second is generative learning that involves thinking outside the limitations of the problem and going beyond the framework that created the current conditions (Barrett, 1995). Argyris (2002) describes this as double loop learning, and he explains that it occurs when improvements are carried out by changing organizations' governing values, and then the actions. He stresses that this requires a shift from organizational defensiveness routines to organizational learning routines.

The improvements are not limited to technical improvements but could address the entire work system, such as its participants, technology, management, organization, work processes, and culture (inspired by Smith & Sainfort, 1989; Carayon & Smith, 2000; Kleiner, 2006). And at a systems level it could also address 'invisible' and intangible factors, such as the organizational social capital (Hasle & Møller, 2007) and relational coordination (Gittell, 2000). When a work system is improved through generative double loop learning, the practice can be called work system innovation.

The new business models for production are based on work system innovation rather than adaptive learning. Therefore, optimization of work system innovation was chosen as the goal for the concept in this case. The task to proceed with was therefore to combine Appreciative Inquiry and problem solving into a concept for optimized work system innovation by addressing their different processes for improvements.

Appreciative Genchi Genbutsu: Co-creation at the Shop Floor

The chosen approach to generate input for the concept could be called *Appreciative Genchi Genbutsu*: Go and see the real thing in action, when it works best, to understand and expand it. This approach was carried out at the production shop floor to identify practice and experiments with combining Appreciative Inquiry and problem solving. The study took place together with a 14-week Lean implementation commissioned from the central Lean office that had focus on creating structures and introducing tools for systematic problem solving. In the following, three exemplars will be described.

Can Appreciative Inquiry be used for proactive problem solving? An operation station at a large automated assembly line had always had a very inconsistent performance with up to 200 stops pr. day. The project manager who was trained in both problem solving and Appreciative Inquiry chose to use the latter to improve the station's performance. She inquired into the situations where the process was at its best, when the station had the fewest stops and the best quality. She found out that at certain times it only had 1-3 stops pr. hour. By identifying the factors that were used when the station worked at its best she found a way to reproduce the better performance and ended up creating a much more consistent performance with only 20-30 stops pr. day, reducing down time with 90 %.

The approach of inquiring into the better performance, learning about factors for success, and expanding them in daily operations is one way to use Appreciative Inquiry for proactive technical problem solving by targeting a process and systematically understand and expand success factors. By being proactive and using generative questions during the process, such as inquiring into 'what could be' after understanding 'the best of what is', it could enable double loop learning of being engaged in whole system change instead of just solving a current problem within its predefined boundaries.

Can a problem solving method be used to learn from success? After Appreciative Inquiry had been introduced in the factory, they were more focused on learning from success but had no systematic way of doing it in practice. Daily performance boards were still only focused on actions when Key Performance Indicators were below target, 'green' meant ignore and 'red' meant take action.

One team had attempted to incorporate 'the daily success' into their performance meetings to learn from success. Without methods to identify, inquire into, and learn from the situations, the agenda point often created no discussion at all, and when it did it was focused on celebration rather than learning and elevating success factors. Effective learning from success requires identification of occasions, a method for inquiry, and formal structure for capturing and sharing the knowledge (Phlypo, 2008).

Another team experienced a useful method after a successful cross-functional project of introducing a new piece of equipment. The team used a problem solving approach with new questions to look for the root causes of success to initiate improvement. The facilitated investigation created some quite surprising success root causes that were shared with peers and captured for incorporation in future projects. The surprise was not the identified causes but rather that the team shared and highlighted causes that a lean coach later revealed he had tried to introduce earlier without success. Only after experiencing them in practice and systematically investigate them did the team acknowledge their validity. This practice of learning from success therefore contributes with two factors for improving the work system: It creates and captures new knowledge, and it creates an opportunity for knowledge sharing with peers from story telling. The story also highlights how a structured process could be used and that it was found useful to incorporate with a method that people were comfortable and familiar with, in this case a *success expansion* version of the well-known A3 template.
As discussed in the previous example, this could also lead to double loop learning by incorporating generative questions.

Can Appreciative Inquiry be used to solve technical problems efficiently? In this third example, an interesting discussion arose after experiencing a traditional problem solving activity. A plastic moulding machine had just broken down as the team leader initiated systematic problem solving (cf. figure 1). In the beginning of understanding the problem they did not get any useful information from the involved technicians. It took a while before a colleague gave a clue: The incident was caused by an operator closing the machine too early, but he was too embarrassed to tell. The team leader had learned that problem solving was a 'no blame game' so he investigated on and found that the direct cause to the problem was caused by closure of the machine before heating it up. In his root cause analysis he asked why

the machine was possible to close before being heated up, which lead to the solution of re-programming the machine to avoid the problem again.

After this, a thought experiment was carried out: Could Appreciative Inquiry have been used instead to solve the problem? The conclusion of the discussion was as follows. After walking through the standard 4D model and asking for 'the best of what is', when it worked better, if something could be learned from other more successful machines, what was wanted instead, etc., the conclusion was that without a root cause analysis for identifying the problem, it would be luck if the Appreciative Inquiry approach would solve the problem as efficiently as problem solving did. As opposed to within a social system, a useful reaction when a problem arises with one machine is rarely to focus on two other machines that performs well and try to expand their success; it was necessary to focus on understanding and solving the problem.

New questions emerged. What had happened, if the technician had not been embarrassed but was instead engaged in creating improvement? What if no colleague gave information about the cause? It became clear that technical problem solving process is a social process that depends on collecting information from people and engaging strengths in the team. What could have happened if the process had continued with the generative question 'what could be' instead of stopping at the first apparent root cause? Could some of these elements from Appreciative Inquiry maybe be combined with problem solving? This will be touched later.

In the next section the learnings from the shop floor study about ways of combining and approaching work system improvement are presented.

Three improvement lenses: Problem solving, success expansion, proactive development

As a result of the observations at the shop floor, three approaches to continuous work system improvement were defined. Within each of the approaches different methods could be used. Three methods from either Appreciative Inquiry or problem solving were observed: Root cause analysis, discovery of success factors, and dream of the future state. Figure 4 shows an overview of the three approaches and the methods observed during the study.

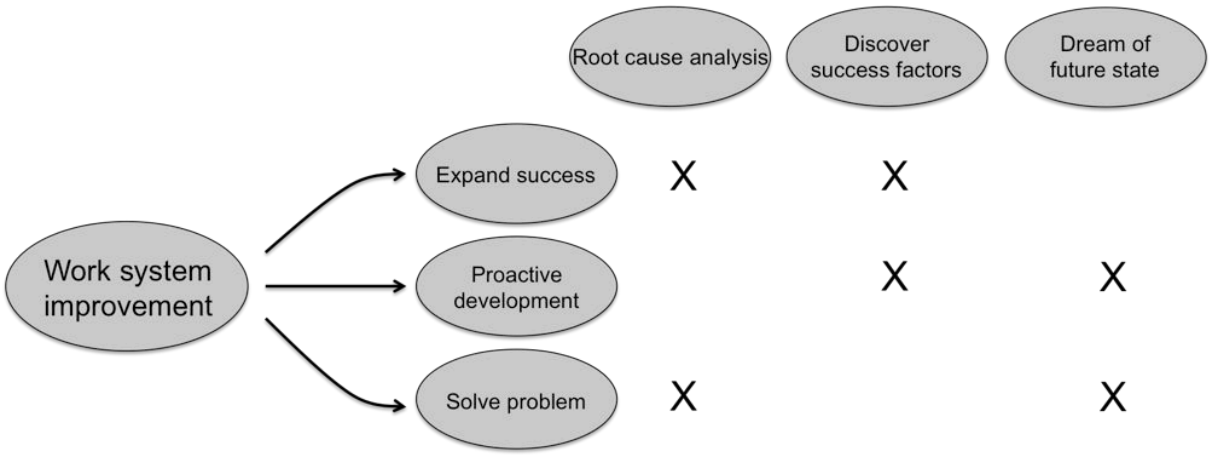

Figure 4: Three approaches to work system improvement, and an overview of methods observed.

Success expansion: Improvement initiated by a positive deviance or success that is inquired into in order to learn and expand the success.
In the study, success expansion was carried out by structured root cause analysis as well as discovery methods from Appreciative Inquiry for expanding success factors, such as interviews and structured dialogue processes.

Proactive development: Proactive improvement that is initiated by an idea or opportunity for improvement.
In the study, proactive development was observed carried out by discovery and expansion of success factors and by a future state dream process.

Problem solving: Improvement initiated by a negative deviance that is addressed in order to solve and improve the situation.
Problem solving was carried out by using root cause analysis and by using a future state dream process.

The use of all these three approaches can expand the opportunities for continuous work system innovation. Most traditional problem solving approaches only focus on reactive problem solving, and miss the opportunities in proactive development and success expansion. Traditional Lean is concerned with both proactive (e.g. Kaizen events with future state mapping, Liker, 2004) and reactive problem solving, but is often most focused on reactive problem solving while gradually raising targets to be able to identify and respond reactively to new problems. Processes based on benchmarking or best practice are focused on success expansion, but they are not used for continuous improvement. Appreciative Inquiry processes are most often proactive and focus on expanding success factors toward a future dream, but are not concerned with reactive continuous improvements from identified problems or success.

These three approaches are ways to initiate continuous improvement of the work system. Each was found able to create both adaptive learning and generative double loop learning. More research is necessary to understand if any of the approaches are better than others at creating work system innovation. An observation was that future-oriented questions often initiated more generative learning than past-oriented questions, and that the biggest difference for work system innovation was whether a generative and future-oriented process was initiated or if the process only was focused on eliminating causes. A deeper understanding was acquired by looking into the differences in the process.

Appreciative Problem Solving

The discussion about Appreciative Inquiry in problem solving cases was initiated during the shop floor study. A conclusion from the study was that the employees found root cause analysis inevitable for many cases of problem solving. At the same time, the process of Appreciative Inquiry was also found useful for solving some problems in a technical context, and could even contribute with engagement of the social system in creating improvements.

A deeper look into the two different processes revealed how they could be combined. Figure 5 shows a schematic illustration of the basics in a root cause based problem solving process.

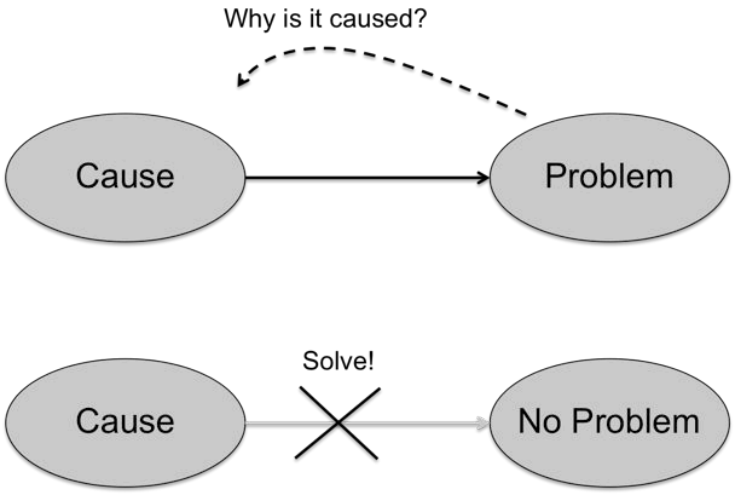

Figure 5: A schematic illustration of the basics in a root cause based problem solving process.

By targeting the direct cause and then the root cause (cf. figure 1), this process works well for many technical problems and is often very efficient because of its direct approach of understanding the system and the problem. The result is often limited to single loop learning because the root cause analysis is based on the existing boundaries of the problem, and execution of the process if often not very engaging.

Figure 6 shows a corresponding illustration of a simplified Appreciative Inquiry based problem solving process.

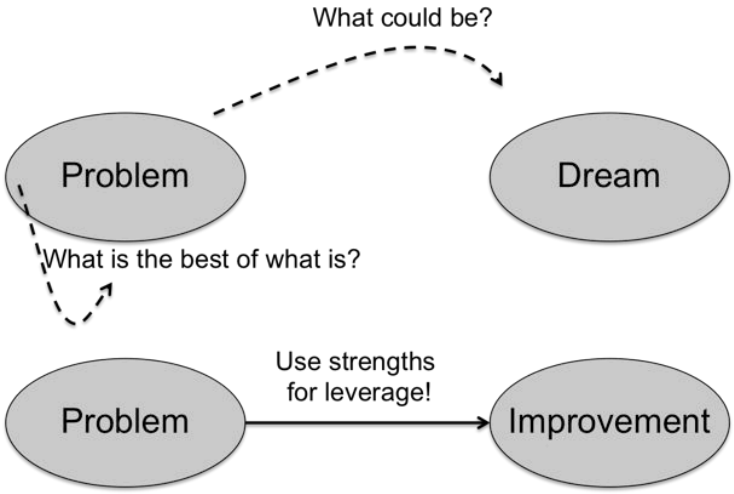

Figure 6: A schematic illustration of the basics in an Appreciative Inquiry problem solving process.

This process is initiated by inquiring into the system when it is most alive and effective, and then it creates change initiated by a future state dream without having to identify the root cause of the problem. This process has the advantage of engaging the social system and of asking generative questions that can optimize double loop learning. In a technical context, it can have the pitfall of not addressing a direct way of solving the problem.

As described, both processes are usable for improvement. In the Appreciative Inquiry literature, problem solving is often regarded as being more useful for technical problems and Appreciative Inquiry for social and more complex issues (Holmberg, 2009). This view is supported by the observations and discussions during the shop floor study.

What if the system is both social and technical? Could the two processes then be combined in order to get the best from each? This was done by a synthesis of the two process representations, and called Appreciative Problem Solving as shown in figure 7.

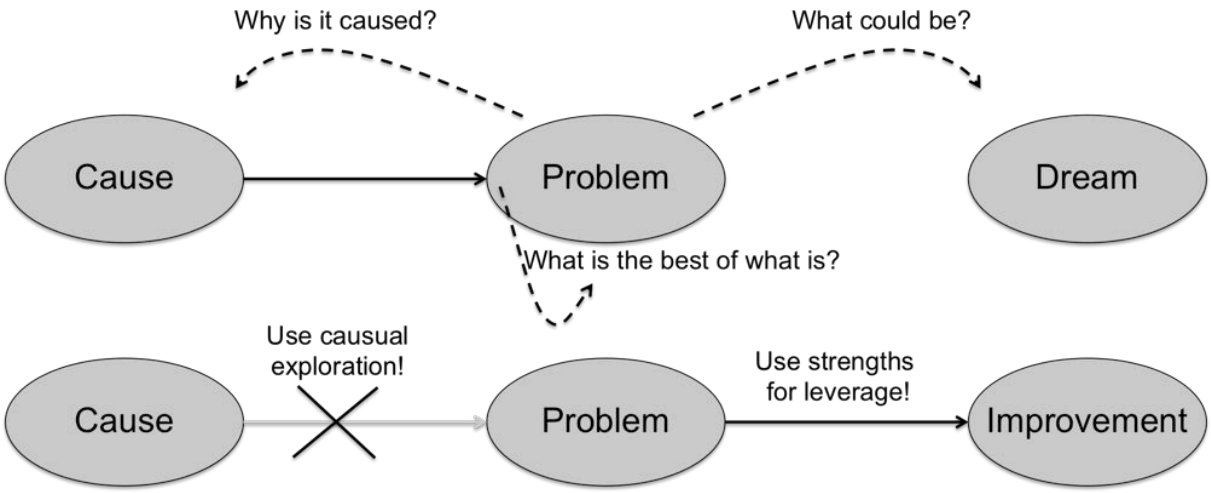

Figure 7: A schematic illustration of the basics in Appreciative Problem Solving.

Appreciative Problem Solving is combining the inquiry of 'the best of what is' with a root cause analysis to understand the system, and then it used the 'what could be' future state dream to generate improvements aimed at double loop learning. Seen from a process oriented perspective it incorporates the best of the two approaches to optimize generative learning. Furthermore, it would allow for the use of applying the Appreciative Inquiry principles to increase learning and enthusiasm in the activity. It is therefore one answer to the question of how to combine Appreciative Inquiry and problem solving for optimized work system innovation.

The model is currently tested empirically at the production facility in order to further explore the combination of Appreciative Inquiry and Lean problem solving in practice.

Conclusion

This paper identified the state of the art within the academic literature, and concluded that no studies had previously described the combination of Appreciative Inquiry and Lean or any other problem solving approach for continuous improvement.

The potential for introducing Appreciative Inquiry to improving problem solving was found to be more enthusiasm, learning, and a wider solution space.

The question of how to combine Appreciative Inquiry and Lean problem solving for optimized work system innovation was answered in two ways:

- By introducing three approaches to continuous improvements that combined the approaches used in Appreciative Inquiry and problem solving.
- By introducing a framework for Appreciative Problem Solving that combines the basic processes within Appreciative Inquiry and problem solving.

Further studies are necessary to add knowledge to the emerging concept of Strength-based Lean and to investigate the practical use of the presented ideas.

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WORK SYSTEM INNOVATION: Designing improvement methods for generative capability

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Abstract

This paper explores how a work system's capability for improvement is influenced by its improvement methods. Based on explorative case study at a Lean manufacturing facility, the methods problem solving and Appreciative Inquiry were compared through in-depth qualitative studies over a 12-month period. The findings show how problem solving leads to solutions inside the existing improvement trajectory, whereas Appreciative Inquiry due to increased generative capability enables solutions outside the existing trajectory. The paper suggests how improvement methods can be designed for appropriate generative capability, which can be useful for practitioners who need to create systemic change.

Keywords: Continuous improvement, Lean, Appreciative inquiry

Introduction

Operations management in industrial production has been focused on creating learning organizations for decades and has focused on engaging everyone in the organization in improvement activities (Delbridge *et al.,* 1998). This has lead to new ways of organizing and managing work systems that go beyond those of scientific management from the industrial age. Liker (2004) argues that Lean, and the Toyota Production System as exemplar, is an exceptional work system for accomplishing the constant drive of organizational learning through continuous improvement. Lean has therefore been a role model for creating work systems and continuous improvement culture in manufacturing as well as by private and public service providers all over the world (Arlbjørn *et. al.*, 2011). Despite its extensive popularity in research and practice there has not been developed consensus about how to implement Lean practices (Brännmark *et. al.,* 2012) and there has been developed a divide between 1) Lean as a collection of tools for concrete problem solving and waste reduction (Hines *et al.,* 2004; Petterson, 2009), 2) Lean as a set of principles to follow (Womack and Jones, 2003), and 3) Lean as a philosophy of long-term excellence based on learning, focus on costumer value, and waste reduction (Liker, 2004; Shah and Ward, 2007). One challenge is shared

across this divide: How to create a lasting continuous improvement culture (Lewis, 2000; Bateman, 2005; Liker 2011). That is, how to establish a work system with a high capability for continuous improvement over time and not just sporadic stand-alone initiatives (e.g. Kaye and Anderson, 1999; Savolainen, 1999). Recently, this challenge has attracted even more interest due to global competition and strategic choices of specializing within narrow parts of the engineering value chain which has increased the need for a high improvement capability (Zhang, 2011). It has therefore become increasingly important to answer how to develop continuous improvement capability. Bessant and Francis (1999) describe that a work system's improvement capability consist of its competence in structured problem solving, idea management, degree of experimentation, ability to connect to strategic goals, and to involve the entire system. The importance of the problem solving competence is stressed widely in the literature (e.g. Berger, 1997; Kerrin, 1999; Terziovski and Sohal, 2000; Delbridge and Barton, 2002; Jørgensen *et al*., 2003; Liker, 2004; Shook, 2008).

Although this apparent importance of problem solving competence has been widely accepted in practice there does not seem to exist any research investigating the role of problem solving for creating improvement capability or whether alternative methods would be better suited for long-term development of improvement culture. The aim of this paper is therefore to investigate these questions.

Over the past years an alternative paradigm for developing organizations has emerged from a critique of problem solving as a change method, stating that while the problem-based paradigm certainly can be useful for creating specific improvements, it may inhibit the capability to create lasting improvement cultures due to a risk of creating defensive posturing, discouraging action and inhibiting creative thinking (Barrett, 1995; Neilsen, 2005; Shendell-Falik *et al.*, 2007), as well as limiting knowledge generation in collaborative work (Baaz *et al.* 2010). Instead, the new paradigm suggests a shift in focus from problems to learning from positive deviations and focusing on affirmative future images. One example of such a change approach is Appreciative Inquiry that has shown capable of creating transformational organizational change (Bushe and Kassam, 2005; Cooperrider *et al.* 2008). Appreciative Inquiry differs from problem solving by reframing the problem into an affirmative topic choice, and instead of investigating root causes of failure it bases change on inquiring into success enablers and strengths from within the organization that can lead to the desired future state (Cooperrider *et al.* 2008). Supporters of this new paradigm argue that a more positive focus better nurtures learning culture and that the active use of positively framed metaphors and future images accelerate change in organizations and thereby enhances the improvement capability.

The purpose of this study is therefore to investigate the differences between these two improvement methods, problem solving and Appreciative Inquiry, through an explorative case study and thereby to explore how the choice of method can influence the development of improvement capability. This leads to two research questions:

RQ1: How can the two different improvement methods be characterized empirically?

RQ2: How does the choice of improvement method influence a work system's capability for improvement?

Understanding a work system's capability for improvement

A work system can be defined as an organizational subunit at the operational level that transforms inputs into outcomes through a work process. Inspired by open systems theory and the work of Smith & Sainfort (1989), Carayon & Smith (2000), and Kleiner (2006) a work system framework is introduced in figure 1.

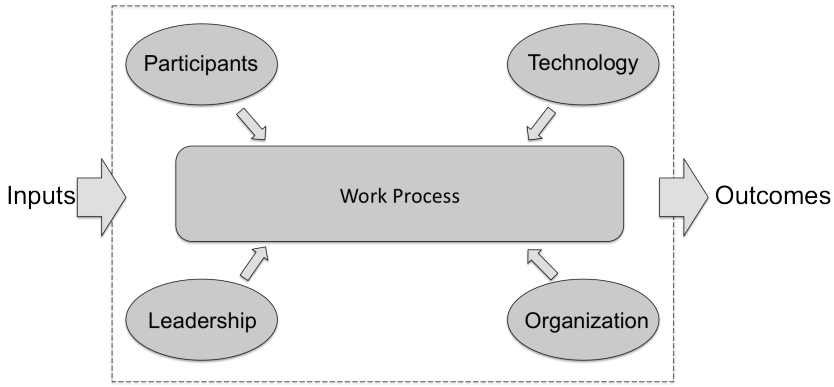

Figure 1 – Work system framework

When in action, the work system transforms inputs into outcomes through its work process based on how the four other elements interact. *Participants* means the actors that participate in the transformation process with their knowledge and actions. *Technology* means the used artifacts, workspace, and methods (such as procedures and mental models). *Leadership* means the actions and expectations from formal and informal leaders that influence the transformation process, such as goals, incentives, language, and meaningful interpretations (Weick and Quinn, 1999). *Organization* means the formal and informal structures, culture, and relational aspects that influence the transformation process in action, such as hierarchy, levels of trust, norms of behavior, and relational coordination (Gittell, 2000). The work process is the series of more or less formalized and tacit steps that lead to transformation of inputs into outcomes based on the interaction between the four other entities.

Based on this work system view the term improvement can be defined as a change of a work system from one state to another that is more efficient or effective in reaching its goals or leads to more desirable side effects. This covers large systemic changes as well as small narrow changes. Since the work system is never in a distinct steady state it can be difficult to measure the effects of a change and to assess if it is an improvement.

It therefore follows that a work system's capability for improvement is its ability to create changes that makes the system more effective or efficient. Bessant and Francis (1999) describe one dimension of such an ability when they argue that a work system's capability for improvement consist of its competence in structured problem solving, idea management, degree of experimentation, ability to connect to strategic goals, and to involve the entire system. It could be argued that these factors are all characteristics of improvement activities, i.e. the process when one or more people work on improvements either as a time-limited project or as part of the daily work. These activities can be more or less structured, experimenting, connected to strategic goals, involving, etc., which will affect their capability for creating work system improvement. Based on this view, the improvement capability can be seen as the product of the improvement activities being practiced in the work system and can thereby be increased by development of the way activities are being practiced.

Understanding the role of improvement trajectories

Dosi (1982) introduces the concept of a trajectory to describe the pattern of normal problem solving activity of creating solutions to selected problems based on selected principles and methods. The selections are based on a paradigm defined as *an "outlook," a set of procedures, a definition of the "relevant" problems and of the specific knowledge related to their solution* (Dosi, 1982). Each paradigm has

established a concept of progress based on the specific trade-offs, e.g. between economic and technological factors, and describes a mental model for identification of problems and valid solutions. An improvement trajectory is thereby the normal practice of creating improvements based on a mental model of relevant problems and valid solutions. An example could be the daily problem solving (*normal practice*) on a production line that is not performing as efficiently as it is supposed to (*mental model of problem*) by investigating if the standard work was followed and if the training system is working sufficiently (*mental model of valid solutions*).

A work system with high improvement capability will therefore need to have an improvement trajectory that is effective in addressing the current challenges, as well as being able to change the trajectory when the challenges change. In order to create lasting improvement capability over time the ability to change and develop improvement trajectories will be key since the improvement needs will change over time. This need will be especially important for creating systemic improvements rather than stand-alone-solutions when introducing Lean and for increasing the improvement capability necessary for flexible and innovative manufacturing.

Barrett (1995) calls the process of changing improvement trajectories for generative learning and states that it involves thinking outside the limitations of the initial problem and going beyond the framework that created the current conditions. Gergen (1978) describes generativity as: *the capacity to challenge the guiding assumptions of the culture, to raise fundamental questions regarding contemporary social life, to foster reconsideration of that which is taken for granted and thereby furnish new alternatives for social actions.* Avital and Te'eni (2009) elaborates on this definition and defines generative capacity as: *comprising the ability to rejuvenate, to produce new configurations and possibilities, to reframe the way we see and understand the world and to challenge the normative status quo in a particular task-driven context.*

In order to carry out an improvement activity that leads to thinking outside or ultimately to change the existing improvement trajectory it is therefore necessary to be able to challenge the normative status quo in a particular task-driven context to produce new possibilities for action, and this ability can be termed the generative capability.

The focus of this paper is therefore to explore how the two different improvement methods affect generative capability and thereby the development of long term improvement capability.

Characterizing the two improvement methods

The conceptual difference between root cause based problem solving and Appreciative Inquiry as improvement methods can be illustrated by the improvement step framework shown in Figure 2 (which is based on earlier work by the authors and Cooperrider et al., 2008; Liker, 2004). The root cause based problem solving method starts from a problem statement (1) that describes the negative gap between the current state and the target state. Then root cause analysis (2) is used to identify reasons for the gap by scientific analysis and experiments. The guiding metaphor for this step is a funnel where the focus is gradually narrowed until the 'correct' point of the cause is found, and then investigated through why-questions until the real root cause is identified. Solving the root cause implies that it is not just the initially apparent problem at the surface that is addressed but a deeper underlying problem. Finally, countermeasures are identified in order to design solutions (6), followed by the necessary activities for realization (7) with subsequent check and standardization. This method is also known as the three Cs: Understand the *concern*, investigate the root *cause*, and implement the *countermeasure* (Delbridge and Barton, 2002). It is also the same basic method used in A3 problem

solving (Shook, 2008; Rother, 2010) and Toyota Business Practice (Liker, 2004). It should be noted though, that these practices used together with the Toyota way philosophy leads to more complex improvement activities that include checking if the process is aligned toward principles of customer first, the company vision, broad stakeholder involvement, purpose of work, visualization, etc. (Liker 2004).

Appreciative Inquiry on the other hand starts by reframing the problem into an affirmative topic (4) and thereby shifts focus from "what to eliminate" into "what should be created". The next step in the process is to create momentum from identifying the best of what already exist that should be sustained and what can be learned from previous success experiences through a success factor analysis (5). This step is a systematic investigation of what knowledge the participants possess that can lead to realization of the affirmative topic as well as uncovering of tacit knowledge. Then, the next step is formulation of a guiding positive image as a future state visualization (3). Finally, design of solutions (6) and activities for realization (7).

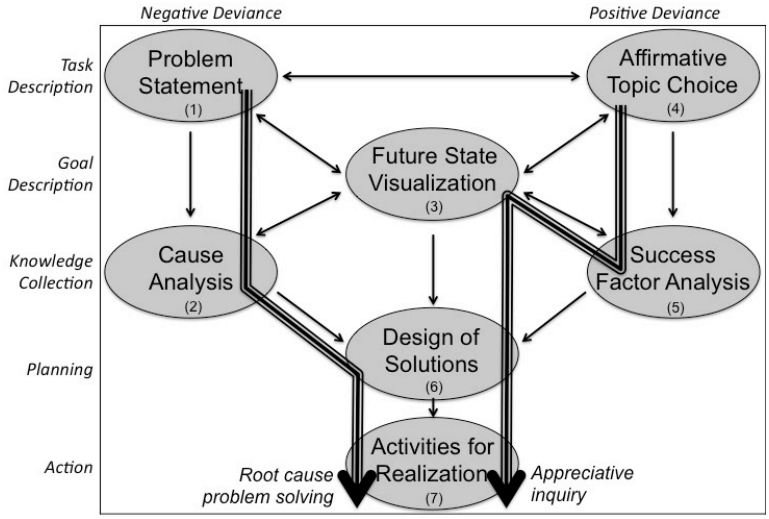

Figure 2 – Improvement step framework

Based on this definition, an improvement activity can be characterized as an Appreciative Inquiry process if it consists of the steps (4), (5), (3), (6), and (7). An improvement activity can be characterized as problem solving if it consist of the steps (1), (2), (6), and (7). And any improvement activity consisting of another combination of steps will be a hybrid.

Methodology

The methodological approach chosen for this research was an explorative case study in a single organization focused on investigating improvement activities. By choosing an explorative case study it was possible to get in-depth knowledge and investigate the contemporary sets of events within their real-life context (as suggested by Yin, 2003). The choice of focus on a single organization made it possible to get a broader understanding of the organizational context as well as to identify an organization with the necessary criteria of having experience with both systematic problem solving and Appreciative Inquiry. Based on the researchers' network an organization was identified that matched these criteria of experience and that accepted to allow full access to their improvement activities for the research project. The selected organization was a medium-sized manufacturing facility of pharmaceutical devices that had been working

with Lean manufacturing for eight years and experimented with appreciative inquiry for four years. The research was carried out by following selected improvement activities carried out in the production and production support departments over a period of 12 months. The improvement activities going on at the facility were very different in nature, ranging from one to 100 participants and lasting from an hour to a month, and it was therefore decided to focus on getting in-depth qualitative understanding rather than seeking a large enough quantity for statistical conclusions. A research design was therefore decided that took advantage of the longitudinal availability by allowing for iterative data collection. The sampling criteria were to study 3 problem solving cases, 3 appreciative inquiry cases, and as any types of hybrid cases that turned up. The following procedure was used: 1) Select a relevant improvement activity to study based on sampling criteria, 2) Study improvement activity through qualitative data collection, 3) Transcribe activity into a narrative and characterize its type, 4) Repeat 1-3 until all sampling criteria have been fulfilled, 5) Analyze and compare cases.

Data collection was carried out through qualitative methods of observation as well as interviews with participants. The advantages of participant observation include greater access to otherwise inaccessible information such as unconscious actions as well as deeper understanding of the context. Disadvantages include introduction of bias of the researcher and the interactions with the key informants that know the researcher is present (Kawulich, 2005). Observation data was collected in a field notebook together with copies of documents and pictures. Some improvement activities as well as interviews were recorded. For each of the cases, the activity was transcribed into a narrative that was analyzed in order to divide the process into steps based on coding. The steps were then categorized based on the improvement framework presented in section 3, and from there the cases were characterized as problem solving, Appreciative Inquiry or hybrid activities. The process character of the cases was then analyzed in order to determine whether the activity led to thinking inside or outside the existing improvement trajectory by investigating whether the mental models of relevant problems and valid solutions were changed. That is, if the process demonstrated generative capability by challenging the normative status quo in a particular task-driven context and produce new possibilities for action, e.g. by changing the limitations of the initial problem and thereby exceeding the initial assumptions about solutions.

Empirical findings

A total of ten improvement activities were followed and the cases were categorized into problem solving, Appreciative Inquiry or hybrid cases based on which steps they used as described earlier. Table 1 shows a summary of the cases' improvement steps and the result of the analysis of the process character. All three problem solving cases started from a problem statement of a negative deviation from the standard and used root cause analysis to deeper understand the problem and its causes, and they used processes that stayed inside the existing narrow trajectory. The hybrid cases were very different in nature. Three out of four had processes that stayed inside the existing improvement trajectory while one had a process outside the existing trajectory. Case 4 was similar to cases 1-3 by starting with a concise problem statement, but instead of generating knowledge about solutions based on investigating root causes it investigated the success factors leading to positive deviations in performance. This led to a solution without needing to understand the causes of problems, but instead by understanding the interventions to create success. The cases 5 and 6 were both based on an affirmative topic choice of sustaining a specific positively deviant performance by investigating success factors in order to create improvement, and both stayed inside the existing

trajectory of continuing the existing practices. Case 7 was more complex, lasted much longer and had more participants involved that the other cases. It started as problem solving with a problem statement and root cause investigation, but was expanded to include the Appreciative Inquiry steps of affirmative topic, future state visualization, and investigation of success factors. The case ended up addressing the original problem statement and using root cause analysis, but it also took a broader systemic view that led to changes not originally considered. During the affirmative topic and future state steps the perspectives expanded and enabled broader ideas to emerge by changing the mental model from narrow focus on improving coordination across departments to creating a new improvement structure, thereby leading to a process outside the existing trajectory.

Two of three Appreciative Inquiry cases led to processes outside the existing trajectories, even though they all used the same steps. Cases 9 and 10 even had the same overall design, but were carried out by different teams with some variations. Case 9 led to a process outside the existing trajectory during future state envisioning and ended up focusing on much wider areas than the immediate problem such as elevation of capability building. Case 10 on the other hand followed the existing improvement trajectory and the existing assumptions about problems and solutions to the apparent challenges ahead. The appreciative inquiry improvement steps alone are therefore not a guarantee for thinking outside the existing trajectory, but may enable it.

*Table 1 – Summary of improvement steps and process character for the ten cases**

Case no.	Task definition		Knowledge collection		Goal description	Process character	
	Problem statement	Affirma-tive topic	Root cause	Success factors	Future state visualization	Inside trajectory	Outside trajectory
1	X		X			X	
2	X		X			X	
3	X		X			X	
4	X			X	X	X	
5		X		X		X	
6		X		X		X	
7	X	X	X	X	X		X
8		X		X	X		X
9		X		X	X		X
10		X		X	X	X	

**White = problem solving cases. Silver = hybrid cases. Carbon = Appreciative Inquiry cases*

Discussion – what enables generative capability?

The second research question of this study asked how the choice of improvement process influences the improvement capability. Since the method was explorative with a limited number of very different cases there is no basis for statistical conclusions but instead opportunity for qualitative investigation of the content to get a deeper understanding. The presented findings lead to a new question of how the processes of these three cases shifted to be outside the existing trajectories while seven did not, i.e. to identify what created the generative capability of challenge the normative status quo in a particular task-driven context to produce new possibilities for action.

The three cases that shifted trajectories had one thing in common; they all used the steps affirmative topic, success factor analysis, and future state visualization. By comparing the story lines of the three cases some similarities were found. In the cases, the affirmative topic led to the formulation of a new challenge that not only was different from the original problem understanding but also implied a new mental model with new assumptions about relevant problems and valid solutions. Furthermore, it led

to the emergence of a new language about the challenge. When the following success factor analysis was carried out it reinforced the new mental model and language while the participants studied past success experiences in the new view. The following future state visualization was then based on a new situational understanding from the affirmative topic and then led to a shift in improvement trajectory. An example of the shift can be shown from case 8: First, the task of "optimizing cleaning time" was reframed into the affirmative topic of "how to achieve perfect efficiency?" Then, the team investigated into past experiences about perfect efficiency such as quick change over, non-stop manufacturing, and coordination between activities. This step reinforced the focus of the affirmative topic and its new language. Based on this language they visualized a future state, i.e. "cleaning only during other stops," that implied a solution outside the existing improvement trajectory. Instead of optimizing the cleaning process, the team investigated how to create a flexible cleaning system with optimal coordination with all planned and unplanned stops on the machine.

Based on these empirical findings the answer to what creates generative capability and thereby solutions outside the existing improvement trajectories can be explained by the following mechanisms, summarized in figure 5:

1) Reformulation into an affirmative topic enables a new understanding to emerge with new assumptions and a new language, i.e. a precursor for a new trajectory
2) The collective investigation of success factors reinforces the new assumptions and language as well as consensus about characteristics of the desired future state
3) When a future state is then defined within the affirmative topic, it can pull the improvement activity to shift to a process outside the existing trajectory

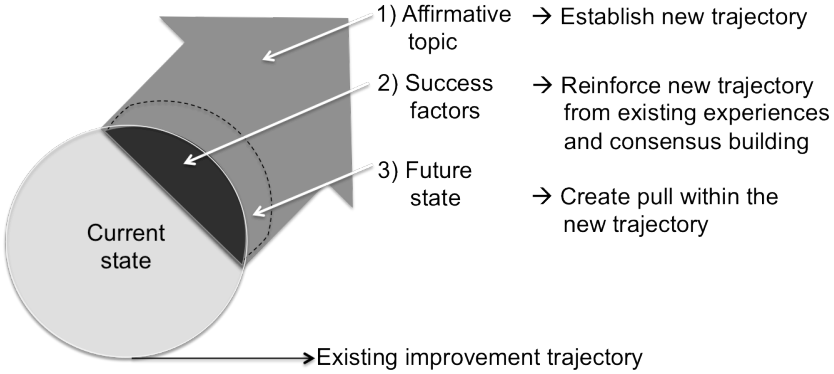

Figure 3 – Steps and mechanisms for creating a trajectory shift through appreciative inquiry

Based on an analysis of the other seven cases another series of patterns was found about barriers for shifting from the existing improvement trajectories. The first pattern was found in cases 1-3 that showed how the root cause analysis step reinforced the existing improvement trajectory by using normative arguments disguised as rational logics. In case 1 the root cause analysis led to the identification of either a training system or a human-machine interface as the root cause based on the rational argument that another design of either could have avoided the problem. The conclusion that an event is caused by a specific system's failure because it should have been designed differently is a logical mistake of normative argumentation based on assumptions within the existing improvement paradigm. This method of "should"-arguments thereby reinforces a focus on creating solutions based on the existing systems because they are the natural targets of this normative attribution, thereby reinforcing the existing improvement trajectory.

Case 4 presented another barrier: Without an affirmative topic choice that points in a

new direction the following steps reinforce the existing trajectory. New knowledge and improvement was created during success factor analysis, but no changed mental models. Cases 5 and 6 illustrated another barrier, namely no change catalyst, i.e. no pull and specific direction from a future state vision, even though they did have an affirmative topic and success factor analysis. Since cases 9 and 10 followed the same steps but only 9 had a process outside the existing improvement trajectory, it can be concluded that following specific steps is not a guarantee for creating a shift and the qualitative analyses pointed to execution of facilitation as an important component. This summarizes to the following barriers for creating processes outside existing trajectories:

1) **Normative logics.** Root cause analysis reinforces the existing trajectory by attributing cause-and-effect relationships based on normative logics.
2) **No new direction.** Without an affirmative topic choice that points in a new direction the subsequent steps will sustain the existing trajectory.
3) **No future state.** Without a future state visualization the improvement activities will not lead to a shift in trajectory even with an affirmative topic choice and a success factor analysis due to a lack of pull past the existing systems.
4) **Execution.** The steps alone are not enough.

Conclusion

This paper shows how improvement activities based on problem solving and Appreciative Inquiry can be characterized empirically based on which improvement steps they use. It was found that the two methods use different mechanisms to create improvements and that these mechanisms influence the improvement capability differently. Problem solving reinforces the existing improvement trajectory and leads to solutions based on existing mental models. Appreciative Inquiry on the other hand uses a combination of steps to increase the generative capability of challenging the assumptions of the existing trajectory and thereby furnish new possibilities for improvements not available in the existing trajectory.

The improvement capability of a work system depends on the effectiveness of its existing improvement trajectory as well as its ability to change trajectories when the challenges from the environment change. It is therefore necessary to be capable in both creating improvements inside and outside the existing trajectory. Work systems with a need for flexibility and adaptiveness or systemic changes such as culture change or Lean implementation will need higher generative capability, and it is therefore suggested for these systems to supplement problem solving methods with more generative methods such as by integrating Appreciative Inquiry into daily improvement activities.

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Enabling Continuous Work System Innovation - the key mechanisms for Generativity

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How do we get everyone's mind into continuous work system innovation?

Due to increasing complexity and pace of organizational environments, competition is no longer about processes but the ability to continuously innovate the whole work system (Teece, 2007). Thus, many organizations have adopted initiatives as Lean thinking, TQM, or structured problem solving.

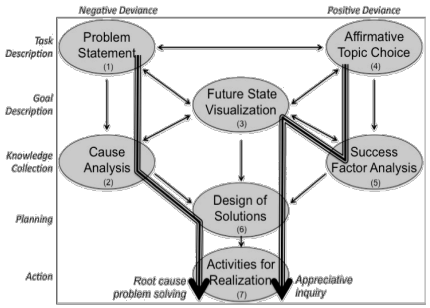
However, these initiatives often fail to create an improvement culture and lead to continuous systemic changes where the normative status quo is challenged regularly, i.e, they lack generativity. We therefore investigated this research question:

>> How can generativity be enhanced in daily innovation activities? <<

Integrating Problem Solving and Appreciative Inquiry into a Framework

Bushe and Kassam (2005) show that Appreciative Inquiry in some cases leads to transformational change due to enabled generativity. Based on this finding an idea emerged that elements of Appreciative Inquiry could be built into daily innovation activities to increase generativity.

The basic steps of problem solving and Appreciative Inquiry were integrated into a framework to be able to operationalize and test the idea. As shown in the framework, the basic elements were found to be independent and possible to combine in any way. Five combinations where investigated in the study.



The Role of Trajectories & Generativity

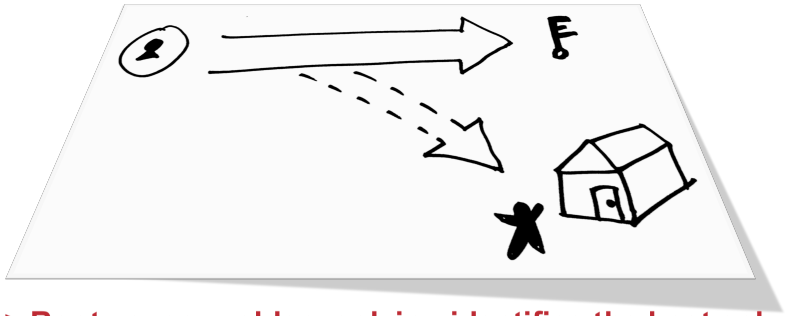
Daily work system improvement needs to balance between exploitation and exploration (Benner & Tushman, 2003), but there is a lack of knowledge about enhancing the latter, which requires the ability to change the improvement trajectory (Dosi, 1982). This ability can also be termed generativity:

Generativity is the capacity *to "reframe the way we see and understand the world and to challenge the normative status quo in a task-driven context."* (Avital & Te'eni, 2009).

Study design

To investigate how generativity could be enhanced in daily innovation activities a study was designed as a 12-month action research in an industrial company. Ten improvement projects using a variety of steps from the framework where studied in action. Qualitative data collection was used to transcribe the projects into narratives that then were analyzed in order to identify trajectory shifts and explain mechanisms.

When do we need the apparent key to a problem and when should we change how we perceive the system?



>> Root cause problem solving identifies the best solution within the existing trajectory whereas Appreciative Inquiry evokes generative capacity allowing trajectory shifts. <<

Findings

The study identified four mechanisms that affected the generative capacity during innovation activities.

1) Root cause analysis created a normative solution space within the existing trajectory.
2) The choice of an affirmative topic enabled a solution space outside the existing trajectory.
3) Analysis of success factors built up generative capacity and lowers the barriers for challenging the status quo.
4) Future state visualization created a shared understanding among the improvement team that enabled action

Implications

The study identified mechanisms that inhibited and enhanced generativity in daily work system innovation activities. Increased generativity led to more solutions outside the existing trajectory, whereas inhibited generativity led to efficient solutions within the existing trajectory.

This points out the central management dilemma between exploitation and exploration that needs to be taken into consideration when designing improvement activities: When do we need to systematically look for the apparent key to a problem and when should we change how we perceive the system?

Conclusion

The study demonstrated how elements of problem solving and Appreciative Inquiry could be used in daily work system innovation activities and illuminated how different mechanisms affected generativity.

>> Generativity can be inhibited or enabled by the choice of activity steps. The balance between exploitation and exploration needs to be managed. <<

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Collaboration partners

resonans

Der behøver ikke være så meget spild i Lean

Lean uden en stærk forbedringskultur er i bedste fald en kortsigtet løsning og i værste fald forbundet med spildt arbejde, mener holdet bag et aktuelt treårigt Lean-forskningsprojekt fra DTU og konsulenthuset Resonans. Med afsæt i erfaringerne fra projektet giver de her deres anbefalinger til at skabe de nødvendige kulturændringer og sætte langsigtet fokus på medarbejdernes udvikling og styrker.

Af Civilingeniør, ErhvervsPhD kandidat, David Hansen, DTU og Resonans
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Lean har det seneste årti fremstået som en mirakelkur, der, med Toyotas topperformance som forbillede, skulle skabe store produktivitetsforbedringer i enhver virksomhed. Imidlertid viser undersøgelser, at 68 procent af danske virksomheder, der arbejder med Lean, ikke er tilfredse med deres implementering [1], mens 76 procent peger på manglende adfærdsændring som den afgørende faktor [2]. Hvorfor er det så svært at få Toyotas Lean-principper til at virke på fuld kraft? Vi har undersøgt dette spørgsmål i et 3-årigt forskningsprojekt, "Styrkebaseret Lean" [3], hos danske og amerikanske virksomheder. Vi mener, der er alt for meget spildt arbejde med mislykkede initiativer, der ikke skaber den nødvendige kulturændring. Indsatserne kunne lykkes med at opbygge effektiv forbedringskultur ved at fokusere på disse tre centrale pointer:

1. **Start med kulturen.** Lean-indsatser, primært fokuseret på effektivisering og optimering af tekniske systemer, kan lede til meget spildt arbejde, hvis ikke medarbejderne ændrer adfærd. I modsætning til mange Lean-eksperters råd om at starte med værktøjer og derfra gradvist skabe nye vaner, så peger vores forskningsresultater på, at opbygningen af medarbejderdreven forbedringskultur kan accelereres ved at starte med kulturændringen gennem inddragende processer og derefter arbejde målrettet med ændring af processer og vaner.
2. **Udøv styrkebaseret ledelse**. Alt for mange Lean-indsatser fokuserer udelukkende på kortsigtet løsning af problemer og lapning af svagheder. Succesfuld forbedringskultur opbygges derimod ved langsigtet ledelsesfokus på at opbygge organisatoriske styrker. Blandt andet ved at

bruge ethvert problem som anledning til medarbejderudvikling med øje for hvilke fremtidige styrker organisationen har brug for bliver udviklet.

3. **Det starter med dig.** Mange Lean-indsatser bliver planlagt af ledelsen og eksperter for at blive implementeret i resten af virksomheden. Men enhver succesfuld Lean-transformation kræver en markant ledelsesændring, så du må gøre dig selv til en aktiv del af forandringen fra start. Ligesom du må blive ved med at sprede energi omkring dig for at holde udviklingen i gang.

Med afsæt i vores fund og erfaringer fra projektet uddyber vi i det følgende de tre pointer og foreslår fem konkrete greb, der har vist sig særligt vigtige for at skabe en forbedringskultur.

Nødvendigheden af forbedringskultur

Forfatter til bogserien The Toyota Way og en af verdens førende Lean-eksperter, Jeffrey K. Liker, fortæller, at han igen og igen ser kompetente virksomheder lykkes med at etablere de tekniske aspekter af Lean, såsom værktøjer og forandret fysisk flow, men at de samtidig fejler gevaldigt i at skabe den nødvendige kulturændring. Han peger på, at virksomhederne i stor stil overser vigtigheden af den sociale transformation og det nødvendige langsigtede fokus. Der er al for lidt fokus på massiv udvikling af ledelse, tydeliggørelse af fremtidsvisionen og på virksomhedernes aktuelle tilstand [4]. Når ledelsen begynder at tænke kortsigtet og bliver utålmodig efter resultater, bliver det ofte til forhastede beslutninger, der ikke gavner udviklingen af den nødvendige kultur. Når Lean ikke starter med at engagere alle i en kulturforandring, går virksomheden glip af enorme optimeringsmuligheder.

Et eksempel fra en amerikansk tandpastafabrik viser forskellen: Et millionprojekt med eksterne konsulenter havde netop afsluttet deres håndtering af et kvalitetsproblem, hvor pakker blev sendt ud uden tandpasta i. En avanceret teknisk løsning stoppede produktionslinjen, hver gang en forkert pakke dukkede op, og en medarbejder kunne herefter fjerne den og genstarte produktionen. Alle var glade! Tre uger senere stoppede de forkerte pakker med at dukke op i systemet. Et tjek viste, at løsningen fortsat var fungerende, og der var samtidig ingen kvalitetsproblemer anmeldt. Den undrende direktør endte med at gå ned i produktionen for at blive klogere. Han så en mærkelig ventilator på båndet foran den avancerede installation og spurgte den linje-ansvarlige om, hvad det var.

Svaret kom prompte: ”Nå, den dér? Bert nede fra vedligehold gad ikke at gå hen til linjen hele tiden og fjerne de tomme pakker, så han satte en ventilator op, der blæser de dårlige pakker ned af båndet!”

På den ene side illustrerer eksemplet, hvilket kæmpe potentiale der ligger i at engagere alle i medarbejderdrevne forbedringer. På den anden side understreger eksemplet en mangel på forbedringskultur, hvor Bert ikke forbedrer proaktivt, og hvor ledelsen satser på et forhastet milliondyrt konsulentprojekt, der kunne være klaret med en ventilator og lidt kreativitet.

Én virkelighed - to logikker

Når det har vist sig svært at forene den nye tekniske struktur med en ny organisationskultur, er det, fordi de opererer ud fra to forskellige logikker. På den ene side er den tekniske logik, der handler om strategisk og operationelt at kunne skabe flow, minimere spild og lave systematisk problemløsning, hvilket kalder på en rationel og analytisk tilgang. På den anden side er den sociale logik, der handler om at skabe ejerskab og engagement. Hvor den tekniske logik handler om at kunne bryde opgaver ned, identificere problemer og lave årsagsanalyser, så handler den sociale logik om at bygge medarbejdere op, skabe mening og styrke engagement gennem at give ansvar, vise tillid og opmærksomhed.

Det er imidlertid vores erfaring, at den første logik er langt mere styrende for mange Lean-indsatser end den anden. Rationalet synes at være at starte med at implementere de tekniske systemer og derefter lade kulturen følge langsomt efter, mens folk vænner sig til ny adfærd. Selv om det lyder logisk, harmonerer det ikke godt med menneskelig natur. Det ligger nemlig dårligt til mennesker at give sig i kast med noget uden at forstå betydningen og uden at føle indflydelse. Det er nødvendigt at skabe mening for at kunne skabe engagement.

Løsningen er derfor at lade den sociale logik være omdrejningspunktet for indsatsen og lade de tekniske metoder og værktøjer understøtte. Kulturforandringen skal initieres ved at skabe en fælles forståelse for den forestående forandring og ved at engagere alle i at ville realisere en tydelig fremtidsvision. Dernæst skal kulturen konstant være omdrejningspunktet for Lean-forløbet. I modsætning til indførslen af de tekniske forandringer, der drives ved at eliminere spild, så skal den kulturelle forandring drives ved at fokusere på

den ønskede adfærd igen og igen. Det er nemlig nødvendigt at gribe folk i at gøre det rigtige og at lære af det, der virker godt. Ny hjerneforskning peger på vigtigheden i gentagelse, positive oplevelser og fokus på den nye ønskede adfærd for at opbygge vaner og kultur [5].

Ledere bør udnytte enhver mulighed for at udvikle medarbejdere

Stærke Lean-kulturer udnytter enhver lejlighed til at udvikle deres medarbejdere på den lange bane. Det er ofte overset, hvor stor indsats Toyota faktisk lægger i at fastholde, inddrage og udvikle medarbejdere [6]. Deres forhold mellem førstelinjeledere og medarbejdere er 1:5 for at optimere tid til coaching og fokus på individuel udvikling. Samtidig er de ikke bange for at kaste nye medarbejdere ud i ambitiøse udviklingsprojekter for at give dem muligheden for at lære. De fleste virksomheder vil sikkert mene, at deres medarbejdere er deres vigtigste aktiv.

Vi vil hævde, at det faktisk er virksomhedens styrker, der er det vigtigste aktiv. Det vil sige, når arbejdsprocesser og medarbejderstyrker tilsammen fungerer optimalt. Når gode Lean-virksomheder satser på medarbejderudvikling, handler det derfor både om at udvikle individer, men i lige så høj grad om proaktivt at satse strategisk på udvikling af virksomhedens styrker, så de matcher fremtidige ønsker og behov.

Det er derfor ledelsens primære opgave at udvikle styrker på den lange bane. Denne ledelsestilgang bliver bakket op af en omfattende Gallup-undersøgelses resultater, der konkluderer, at den bedste indikator for performance og engagement er svaret på, om medarbejderne har mulighed for at bruge deres styrker hver dag. Dermed er ledelsens vigtigste opgave at udvikle og sætte medarbejderstyrker i spil [7]. Disse pointer suppleres yderligere af følgende forskningsresultater omhandlende udvikling af forbedringskultur:

Det starter med dig!

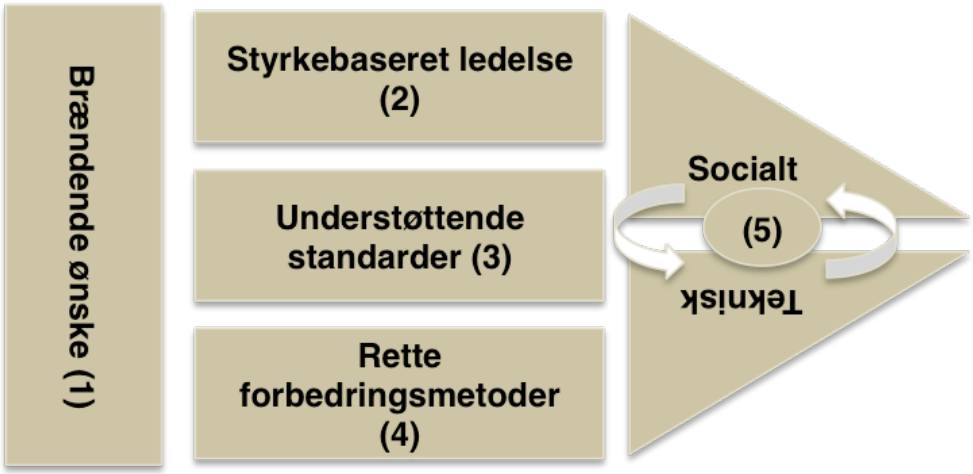
Succesfuld Lean-implementering kræver et opgør med den traditionelle tilgang til implementering, hvor ledelsen identificerer et behov og designer en løsning, som resten af organisationen skal efterleve. Når målet er at skabe kulturforandring til en medarbejderdreven forbedringskultur, så er det en opgave, der kræver oprigtigt engagement. Det kan ikke kræves. Det er noget, man som leder skal gøre sig fortjent til, og for mange kræver det en holdningsændring. At gøre det

på en oprigtig og troværdig måde forudsætter en ledelse, der har erkendt, at forandringen starter med dem selv, og som derfor er parat til at tage konsekvensen og bringe sig selv i spil. Overvej for eksempel dette spørgsmål: Hvordan kan jeg og vi som ledelse gøre os fortjente til vores medarbejderes initiativ og engagement?

En yderligere opgave for at udvikle og fastholde forbedringskultur er at skabe energi og engagement. Termodynamikkens anden lov beskriver, hvordan et system automatisk bliver mere og mere uordentligt (entropien stiger), hvilket betyder, at det er nødvendigt at tilføje energi for at fastholde tilstanden. Helt praktisk betyder dette vilkår, at det er nødvendigt med løbende forbedringer for blot at fastholde et performanceniveau, og nødvendigt med endnu mere for løbende at skabe reelle forbedringer. Der er derfor en vigtig ledelsesopgave i hverdagen at bringe positiv energi med på arbejde og dermed gøre sig fortjent til engagement og en forbedringskultur.

Fem greb til at skabe forbedringskultur

Vi har operationaliseret vores erfaringer i en nedenstående model med fem greb, der er særligt vigtige til at skabe forbedringskultur:



Figur 1. Fem greb til udvikling af forbedringskultur.

1) Engagér alle i et brændende ønske: De fleste virksomheder har en vision og sætter ambitiøse mål, men få gør dem attraktive og levende for alle. Mennesker motiveres ikke af tal alene, men af meningsfuldhed og deltagelse. Når mennesker har et attraktivt formål at stræbe efter, så styrker det engagement og samarbejde og inspirerer til at bidrage og gøre en forskel. Hos Toyotas kalder

man integrationen mellem et brændende ønske og de daglige driftsmål for Hoshin Kanri.

Dette understøttes af forskning, der beskriver, hvordan positive fremtidsbilleder og attraktive metaforer accelererer organisatorisk transformation [8] [9].

2) Udøv styrkebaseret ledelse: Hvis ledelsen er for fokuseret på kortsigtet problemløsning og lapning af svagheder er det svært at nå ud over en brandslukningskultur. I stedet bør ledelse være fokuseret på proaktivt at engagere og udvikle organisatoriske styrker på den lange bane. Blandt andet ved at bruge ethvert problem som anledning til medarbejderudvikling med øje for, hvilke fremtidige styrker organisationen har brug for. Desuden har lederne en opgave i at skabe energi og engagement for at holde gang i forbedringskulturen.

3) Skab en kultur for understøttende standarder: Standarder skal ikke blot sikre effektivitet og kvalitet, men skal stræbe efter højere effektivitet og kvalitet. En lille, men vigtig forskel, idet det første opmuntrer til kontrol, mens det andet opmuntrer til læring og udvikling. Understøttende standarder flytter fokus fra, hvor fejlen er, til, hvordan kan vi blive bedre. Der findes et stort repertoire af understøttende standarder til både drift og ledelse, for eksempel visuel ledelse som Obeya (stort rum med visualiseringer af data), aktivitets-kort (for eksempel Kamishibai og T-kort) og træningsstandarder.

4) Brug forbedringsmetoder til både problemløsning og innovation: Mere helhedsorienterede forbedringsmetoder som Appreciative Inquiry kan integreres i det daglige forbedringsarbejde til løbende at videreudvikle kulturen og håndtere mere komplekse problemstillinger og initiere ud-af-boksen-tænkning. Systematisk coaching til løbende udvikling af alle medarbejderes forbedringskompetencer hjælper til at forankre forbedringsmetoder i kulturen.

5) Tænk samskabelse som basis for forbedringer: Mennesker kan bedre forstå og engagere sig i det, de er med til at skabe. Ved at tænke involvering på alle niveauer og i alle aspekter af arbejdet etableres et tidligt ejerskab og loyalitet, der sikrer en hurtigere implementering, men også inviterer til yderligere forbedringer, som ledelsen ikke selv har haft øje for. I Toyota kalder de det for Nemawashi. Denne tilgang øger samtidig organisatorisk og individuel læring,

relationer på tværs af organisationen og gør organisationen robust og bedre rustet til at stå sammen om udfordringer.

Så er I på rette vej med jeres Lean-indsats? Vi håber, vi med denne artikel har inspireret til fornyet fokus på sammenhængen mellem en effektiv Lean-indsats og fokus på en stærk medarbejderdreven forbedringskultur.

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resonans

Om forfatterne

David Hansen er er civilingeniør og erhvervsforsker. Han er konsulent hos Resonans, hvor han indsamler og udbreder viden om Lean og styrkebaseret ledelse i Danmark og internationalt. Han er desuden tilknyttet Danmarks Tekniske Universitet som ph.d.-stipendiat, hvor han siden 2009 har forsket i afdelingen for service- og produktionsledelse, samt hos Jeffrey K. Liker på University of Michigan.

Henrik Kongsbak er partner i Resonans og har gennem de sidste 15 år bistået erhvervsledere fra mere end 200 virksomheder med at skabe nye løsninger i spændingsfeltet mellem forretning og engagement. Henrik rådgiver og coacher topledere og designer og gennemfører intensive ledelsesudviklingsprogrammer. I 2009 blev han udnævnt til Årets Konsulent af Berlingske Nyhedsmagasin.

resonans

Hvad er jeres forbedringsstrategi?

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Introduktion

De færreste organisationer tænker strategisk over hvordan de skal fokusere deres forbedringsindsatser, og for flere og flere bliver forbedringskompetence en helt afgørende strategisk disciplin. Her er en invitation til at genbesøge jeres forbedringsstrategi og inspiration til bedre ledelse af den daglige forbedringsindsats gennem nye metoder baseret på Lean og styrkebaseret ledelse.

Initiativer til løbende forbedring, fx sammen med Lean, har succesfuldt fanget opmærksomheden hos organisationer i alle sektorer og brancher og sammen med dem rationelle forbedringsmetoder baseret på den videnskabelige metode. Resultatet mange steder er daglig ledelse, der ønsker at identificere og løse problemer gennem performance monitorering og hurtig rod-årsags-problemløsning for at forbedre arbejdsprocesser.

Men hvis dette bliver til et ensidigt fokus på at eliminere problemer kan fokus blive flyttet væk fra et andet centralt aspekt af løbende forbedring, nemlig at styrke organisationens nødvendige kapabilitet, dvs. opbyggede færdigheder og rutiner, til at levere på strategien og at opnå visionen. Kapabilitetsopbygning foregår nemlig stærkest gennem metoder, der fokuserer på at opbygge ønsket kultur ved at lære af succesfulde oplevelser og at diskutere ønskede fremtidsstadier. Det betyder altså, at der er to dimensioner, der begge er nødvendige, men som kan skabe et dilemma i den daglige forbedringspraksis: Skal ledelse fokusere på at løse problemer eller opbygge kapabilitet?

Denne artikel præsenterer forskellige forbedringsstrategier, der kan håndtere dette dilemma, forklarer hvordan et forbedringssystem kan forstås og introducerer en empirisk testet model til at designe daglige forbedringsmetoder, der understøtte den valgte forbedringsstrategi.

Forbedringskapabilitet som strategisk disciplin

Den aktuelle offentlige debat i Danmark peger på en produktivitetskrise. Vi er nødt til at øge vores produktivitet for at opretholde den høje velfærd, da der bliver færre

hænder til at løfte fleres behov og da der er stigende global konkurrence. Eksempelvis kæmper offentlige serviceudbydere med at levere nok service for ressourcerne og produktionsvirksomheder kæmper med at være konkurrencedygtige når østeuropæiske og asiatiske konkurrenter kan producere det samme billigere. Så der er ingen tvivl om at produktivitet er en vigtig strategisk konkurrenceparameter. Den offentlige debat forholder sig dog ikke til det egentlige problem, nemlig at vi alt for mange steder ikke udnytter medarbejdernes potentiale til at forbedre arbejdet. I stedet forsøger vi med kortsigtede lappeløsninger, fx gennem konsulentdrevne rationaliseringer eller optimistiske strategiændringer uden at ville gøre det, der skal til.

Flere virksomheder er derimod lykkedes med at gøre forbedringskapabilitet til en strategisk disciplin, der har sikret dem overlevelse ved at skabe en forbedringskultur, hvor alle medarbejdere bidrager med løbende forbedringer. Det handler fx om dagligt at forbedre arbejdsgange, fjerne spild, at fjerne bureaukratiske forhindringer, løse problemer, og at finde på og gennemføre forbedringstiltag. Alt dette er noget, der kan skabe mere værdi for kunderne for færre ressourcer. Samtidig øger medarbejderdrevne forbedringer ofte både engagement og trivsel fordi det skaber intelligente forbedringer og handler ikke bare at løbe hurtigere.

Høj forbedringskapabilitet giver nemlig mulighed for at konkurrere på andre parametre end omkostninger, og så kan vi pludseligt være med. Vi kan nemlig konkurrere på fleksibilitet, innovationsevne, kvalitet og hastighed hvis vi er gode nok til disciplinen forbedring.

Hvad er forbedringskapabilitet?

Organisationers forbedringskapabilitet kan altså være en strategisk afgørende kompetence. Følgende historie fra en dansk fabrik illustrerer to dimensioner, der kan synliggøre hvad forbedringskapabilitet er for noget:

"Sam var frustreret idet maskinen havde været nede i dagevis grundet et trivielt problem. Endelig var defekten fundet og maskinen oppe at køre igen. Men Sam var endnu ikke tilfreds. Han vidste at det ville ske igen og at organisationen ikke var i stand til at koordinere sine forbedringsindsatser godt nok. Han inviterede derfor nøgleinteressenter sammen til en række workshops, der endelig gendesignede den daglige performancemødestruktur og der ledte til ny træning af teamlederne. Resultatet: Bedre koordination mellem enhederne, hurtigere problemløsning og bedre kvalitet og effektivitet."

Først eliminerede Sam et performance problem og dernæst styrkede han organisationens kapabilitet til at løse fremtidige problemer. Således kan forbedringsindsats enten realisere effekt direkte eller opbygge organisationens forbedringskapabilitet og dermed effekt på sigt. Forbedringsindsats kan derfor opdeles i to dimensioner: Realiserings*effektivitet og forbedringskapabilitet*. Begge er vigtige dimensioner, men balancen mellem dem afhænger af organisationens strategi.

Realiseringseffektivitet kan defineres som mængden af realiseret forbedring per forbedringspotentiale. Dvs. hvor stor en andel af de eksisterende idéer bliver realiseret med effekt, fx ved at øge kvalitet, effektivitet, gennemløbstid, spild, arbejdsmiljø, osv.

Forbedringskapabilitet kan defineres som organisationens evne til at skabe forbedringspotentiale, såsom evnen til at få nye forbedringsidéer og potentialet af disse. Forbedringskapabilitet er dermed afhængigt af elementer som koordinering, forbedringsmetoder, sammenhæng mellem forbedringsmål og organisationens strategi, social kapital, osv. Det at have en høj forbedringskapabilitet kaldes også dynamisk kapabilitet og er af Zollo & Winter (2002) eksemplificeret som at have “et tillært og stabilt mønster af kollektiv aktivitet gennem hvilken organisationen systematisk genererer og modificerer operationelle rutiner i jagten på øget effektivitet.”

Formulering af en forbedringsstrategi

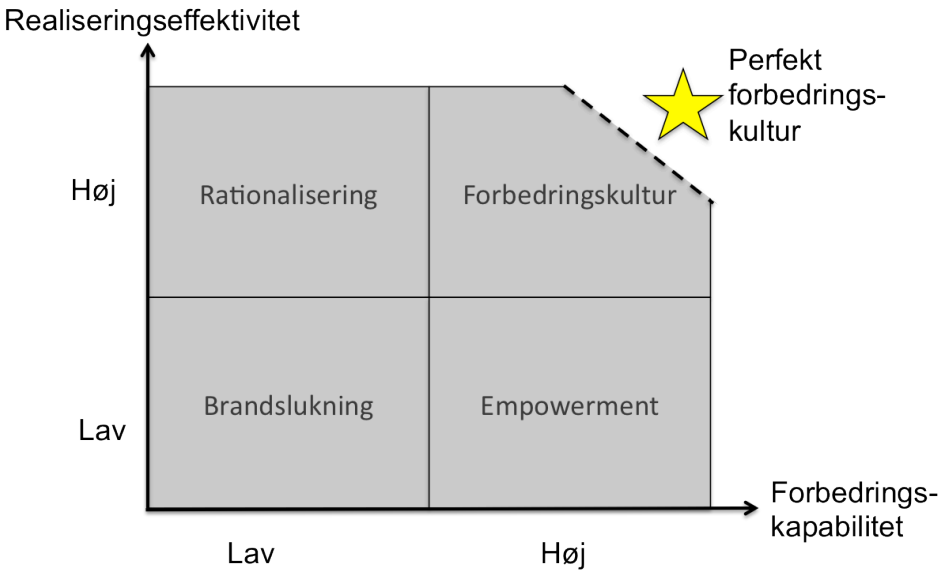
En organisations forbedringshastighed er et resultat af både realiseringseffektiviteten og forbedringskapabiliteten. Matematisk set er forbedringshastigheden produktet af de to variable. Realiseringseffektivitet har enheden forbedringseffekt per potentiale og forbedringskapabiliteten har enheden potentiale per tid. Når de to ganges sammen fås forbedringshastigheden med enheden forbedringseffekt per tid.

Forbedringshastighed = Realiseringseffektivitet x Forbedringskapabilitet

Begge dimensioner bidrager derfor og er vigtige at fokusere på. Det er dog ikke muligt at fokusere alle sine ressourcer på realisering uden at miste fokus på kapabilitetsopbygning og omvendt. Derfor er det svært at opbygge en forbedringskultur, hvor begge dele opnås samtidig. Derfor er det fordelagtigt at tage en strategisk tilgang til sin forbedringsindsats, så ressourcerne bliver lagt hvor de kan få den største effekt. Hvor en telekommunikationsvirksomhed i en periode kan have behov for at fokusere på rationalisering gennem realiseringseffektivitet kan en

nystartet produktionsfacilitet have behov for at fokusere på at opbygge forbedringskapabilitet gennem uddannelse og ledelse, så hele faciliteten bliver i stand til at tage initiativ og ejerskab for medarbejderdrevne forbedringer.

Som en konsekvens af dette bør enhver organisation aktivt beslutte hvilken forbedringsstrategi, der passer til sine strategiske udfordringer og dermed hvordan opbygningen af realiseringseffektivitet og forbedringskapabilitet skal balanceres. Figur 1 viser en model for forbedringsstrategier imellem de to dimensioner.



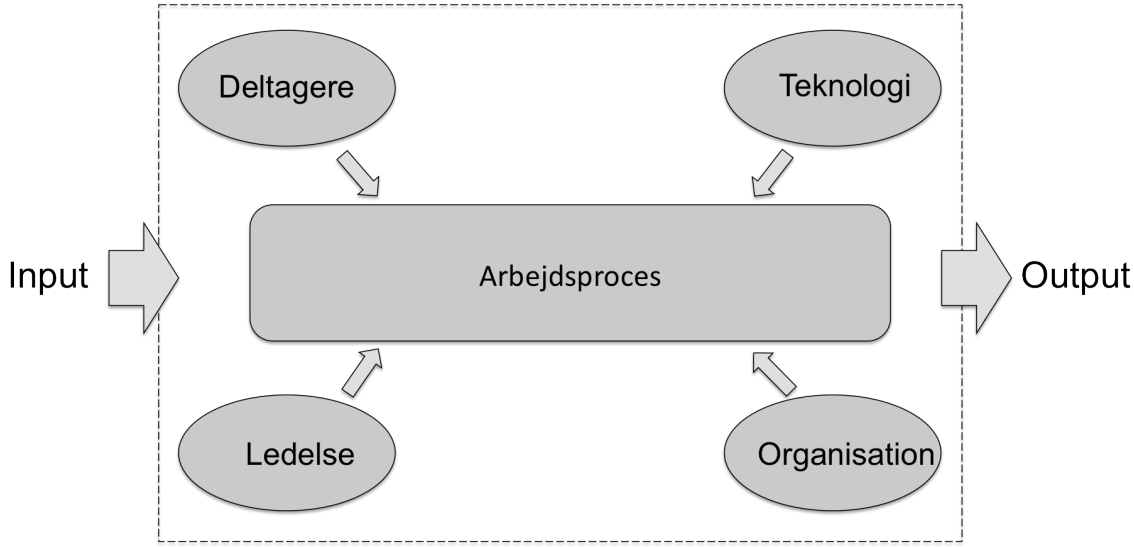
Figur 1. Forbedringsstrategier mellem realiseringseffektivitet og forbedringskapabilitet.

At balancere de to dimensioner handler om at få dem koblet og skabe synergi. Mange kan sikkert genkende situationer, hvor de har været så optagede af at realisere kortsigtet effekt, at deres forbedringsinitiativ slet ikke opbyggede nogen forbedringskapabilitet. Ligeledes kan mange sikkert genkende at have været igennem et initiativ, der var så optaget af at skabe læring, godt teamwork og forståelse for strategien, at det slet ikke bragte nogen reel effekt med sig i form af varige forbedringer. Mange gør endda begge dele på skift, hvilket samlet set resulterer i en utilstrækkelig effekt og en svag strategi. En succesfuld forbedringsstrategi handler om at skabe forbedringskultur ved at kombinere de to dimensioner.

Et system til at realisere forbedringsstrategien

Når forbedringsstrategien er formuleret skal den operationaliseres, så det daglige arbejde og forbedringsindsatser understøtter det strategiske valg i forhold til

realisering og kapabilitetsopbygning. Det operationelle arbejdssystem kan illustreres med en model udviklet på DTU af forskningsgruppen Work System Design på DTU Management Engineering. Figur 2 viser denne operationelle illustration af et arbejdssystem, der er inspireret af tekster om systemteori af Smith & Sainfort (1989), Carayon & Smith (2000), og Kleiner (2006). Et arbejdssystem kan defineres som en organisatorisk enhed der transformerer inputs til output gennem en arbejdsproces.



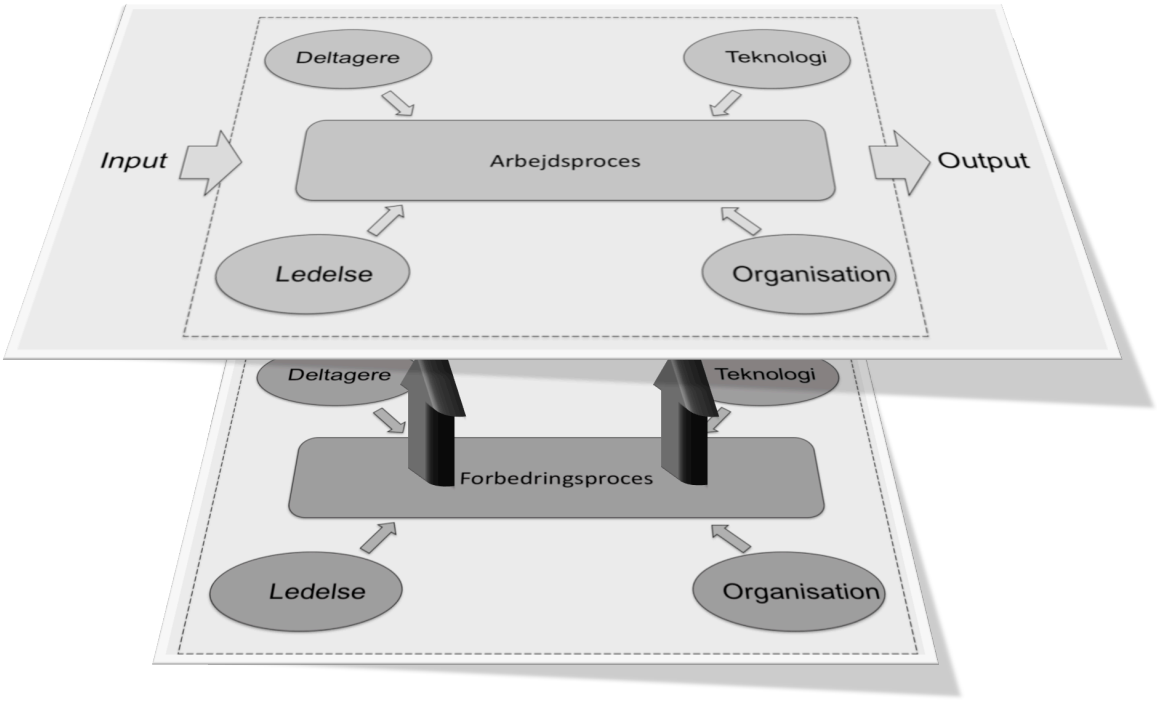
Figur 2. Operationel illustration af et arbejdssystem.

Når systemet arbejder sker transformationen gennem den måde de fire omgivende elementer interagerer. *Deltagere* betyder de mennesker, der aktivt deltager i transformationsprocessen med deres viden og handlinger. *Teknologi* betyder objekter, det fysiske rum og metoder (fx procedurer og mentale modeller), der bliver anvendt. *Ledelse* betyder de handlinger og forventninger fra formelle og uformelle ledere, der influerer transformationsprocessen, såsom mål, belønning, sprog og meningsdannende fortolkninger (læs fx Weick and Quinn, 1999). *Organisation* betyder de formelle og uformelle strukturer, kultuer og relationelle aspekter, der påvirker transformationsprocessen, såsom hierarkier, tillid, adfærdsnormer, social kapital og relationel koordination (læs fx Gittell, 2000). Selve arbejdsprocessen er den serie af trin, der skaber selve transformationen baseret på interaktionen mellem de fire andre elementer, og den består dermed både af mere eller mindre formaliserede trin samt tavs viden.

Med denne model som basis kan operationel forbedring illustreres som en forandring af arbejdssystemet fra et stadie til et andet, der er mere effektivt eller mere effektfuldt opnår sine mål. Da arbejdssystemmodellens afgrænsning kan placeres

omkring ethvert system kan en forbedring selvfølgeligt også foregå mellem sådanne sub-systemer, idet de dermed forbedrer det overordnede system. Så forbedringer kan altså både være store systemiske forandringer og små afgrænsede forbedringer.

Realiseringseffektivitet kan illustreres som evnen til at skabe en direkte forbedring af et eller flere elementerne i arbejdssystemet. Forbedringskapabilitet er derimod evnen til at forbedre den proces, der skaber forbedringer af arbejdssystemet. Dette mere abstrakte begreb kan illustreres som et underliggende arbejdssystem, hvis arbejdsproces leverer forbedringer. Når dette underliggende forbedringssystem bliver bedre øges forbedringskapabiliteten. Figur 3 illustrerer arbejdssystemet og det underliggende forbedringssystem.



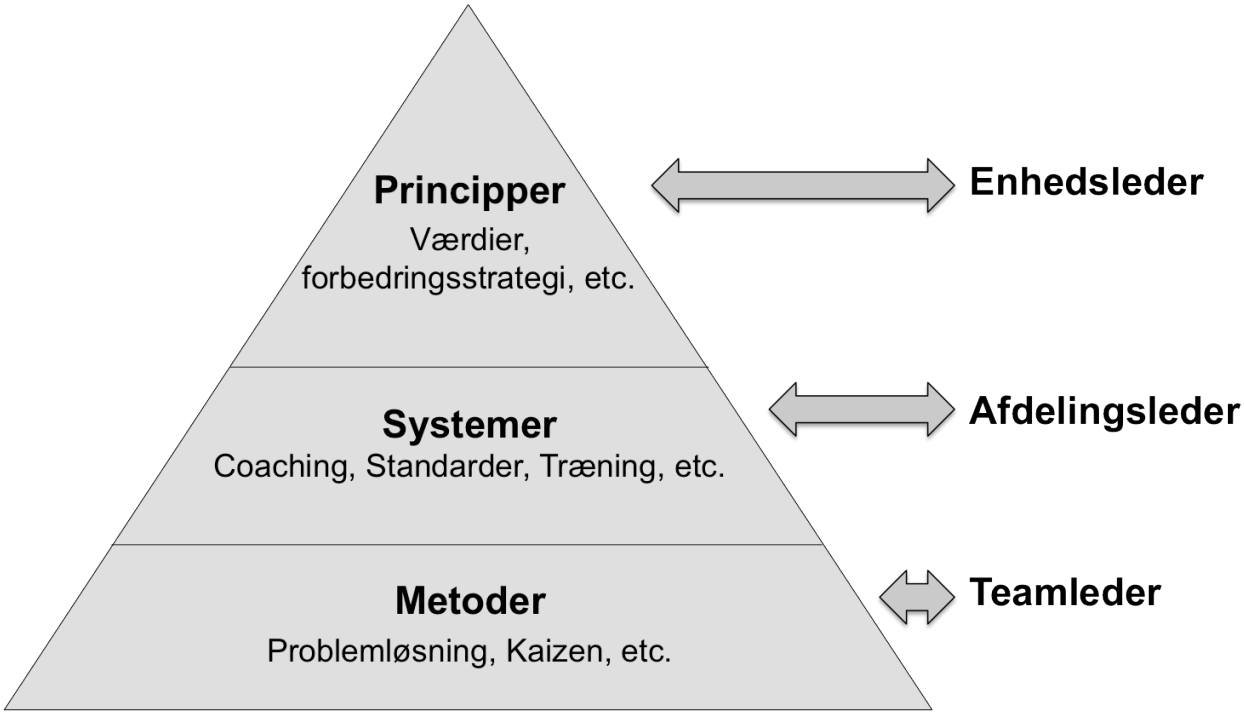
Figur 3. Arbejdssystem og underliggende forbedringssystem.

Realiseringseffektivitet kan illustreres med pilene, altså evnen til at implementere og forandre arbejdssystemet. Forbedringskapabiliteten kan forstås som samspillet og potentialet i forbedringssystemet. Forbedringskapabiliteten kan derfor øges gennem mange forskellige håndtag: Gennem bedre udvælgelse og uddannelse af deltagerne, gennem bedre organisation af forbedringsarbejdet, gennem bedre ledelse eller gennem bedre teknologi, såsom forbedringsmetoder. Bessant & Francis (1999) peger i et forskningsprojekt på at de vigtigste kompetencer til strategisk løbende forbedringsevne er struktureret problemløsning, et etableret ide-system, plads til

eksperimentering, evnen til at involvere alle medarbejdere og evnen til at forbinde indsatserne til de strategiske mål.

Forbind forbedringsstrategi, -system og -metoder

Toyotas Produktionssystem, som mange inspireres af som begrebet *Lean*, er netop kendetegnet ved et veldesignet underliggende forbedringssystem, der dagligt både understøtter realiseringseffektivitet og løbende opbygning af forbedringskapabilitet. Dette fungerer blandt andet ved at adskille de forskellige ledelseslags opgaver, så 1. linjeledere koncentrerer sig om at understøtte den daglige drift og at udvikle medarbejdere mens afdelingslederne koncentrerer sig om at understøtte hele forbedringssystemet, så det består af de rigtige metoder, værktøjer og adfærdsmønstre. Samtidig fokuserer enhedslederen på at det er de rigtige principper, der bliver anvendt, herunder forbindelsen til de strategiske mål, se figur 4.



Figur 4. Forskellige ledelseslag har forskelligt ansvar for forbedring.

Lean bliver ofte kopieret blindt uden stillingtagen til hvilken forbedringsstrategi det skal understøtte. Derfor finder mange organisationer sig ofte midt i et virvar af japanske problemløsningsmetoder uden et understøttende forbedringssystem og uden en diskussion af hvad de skal bruges til. De fleste forbedringsprogrammer er centreret omkring systematisk problemløsning baseret på den videnskabelige

metode; rod-årsags-problemløsning. Der findes dog også andre forbedringsmetoder, der er centreret mere omkring at skabe forbedringskapabilitet gennem læringsprocesser, samskabelse af visioner og forstærkning af allerede eksisterende organisatoriske og individuelle styrker (læs fx. Brun og Ejsing, 2010).

Når forbedringsstrategien er formuleret og et forbedringssystem er etableret er næste skridt at udvælge passende metoder, der kan understøtte behovet. Hvis ikke metoderne er nøje udvalgt til strategien kan de nemlig hurtigt diktere effekten i forhold til de to dimensioner. For eksempel bliver systematisk problemløsning initieret som reaktion på identificeret dårlig performance gennem daglig monitorering, hvilket kræver et fokus på negative afvigelser. Det øger realiseringseffektiviteten, men har den bivirkning, at det ofte fjerner fokus helt fra at lede efter det, der gik godt.

Forskningen viser at kapabilitetsopbygning bliver udviklet hurtigst, når det går gennem forstærkning af positive oplevelser og gentagelse af rigtig adfærd i ugevis for at opbygge nye neurologiske nervebaner (læs fx Rock & Schwartz, 2006). Hvis dette skal ske succesfuldt, kræver det et dagligt fokus på positive afvigelser og plads til at øve ny adfærd uden frygt for at blive udpeget som skyld i dårlig performance. Dermed vil reaktiv problemløsning skifte fokus mod realiseringseffektivitet snarere end opbygning af forbedringskapabilitet alene på grund af metodens indbyggede fokus.

Som udgangspunkt for at udvælge de rigtige forbedringsmetoder præsenteres der i de næste afsnit to metoder til forbedring: Problemløsning og Appreciative Inquiry (på dansk ofter oversat til anerkendende tilgang eller anerkendende udforskning). Baseret på de to metoder præsenteres en model til at designe passende forbedringsmetoder til sin forbedringsstrategi.

Problemløsningsmetoden

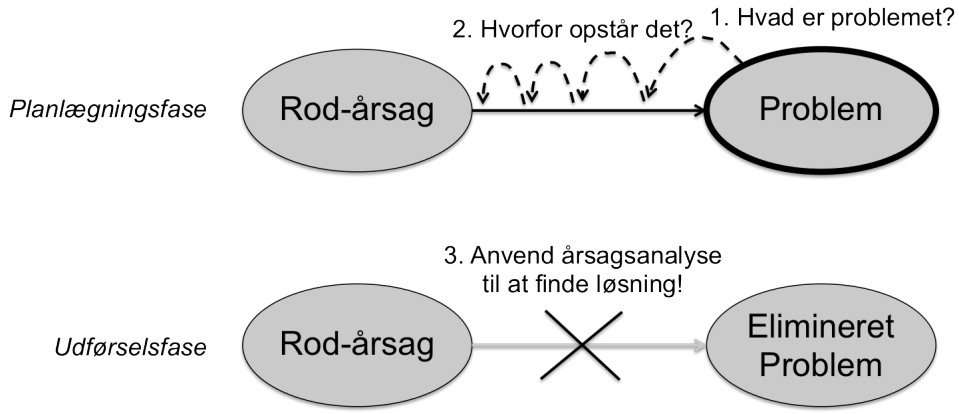
Problemløsning gennem rod-årsagsanalyse er en velbeskrevet og vidt udbredt metode til løbende forbedring. Ved at undersøge uønskede hændelser og forstå deres årsager kan denne metode bruges til at sikre at problemerne ikke genopstår ved at eliminere problemernes årsager ved roden (Læs fx Liker, 2004, og Shook, 2008). Nogle af de mest udbredte metoder, der baserer sig på rod-årsagsananysen inkluderer Demings PDCA cirkel, Six Sigmas DMAIC metode og Leans A3 systematiske problemløsningsmetode, også kendt som Toyota Business Processes.

De fleste problemløsningsaktiviteter initieres når der er en afvigelse mellem en ønsket tilstand og den målte nuværende tilstand. Generelt kan problemløsningsmetoden simplificeres til tre trin, på engelsk kaldet de tre C'er: Forstå din *Concern,* undersøg *root Cause* og implementer en C*ountermeasure*.

Metoden foregår ved først at definere problemstillingen (Concern) og at forstå situationen, derfra indsamles gradvist mere og mere information indtil den direkte årsag til problemet er fundet. Dernæst anvendes en serie af "hvorfor" spørgsmål til at identificere den underliggende rod-årsag (Cause) der har skabt problemet. Når den underliggende årsag er fundet kan en løsning (Countermeasure) findes, der kan eliminere problemet og sikre at det ikke genopstår en anden gang.

Målet med problemløsning gennem rod-årsagsanalyse er ikke blot at eliminere problemet på overfladen, men at stille spørgsmål til de underliggende systemer. Dermed kan problemløsning både skabe læring på enkelt og på dobbelt loop niveau (se Argyris, 2002) afhængigt af hvor dyb årsagsanalysen foretages og hvilken løsning, der implementeres.

Den basale problemløsningsmetode er illustrereret på figur 5. Planlægningsfasen viser årsagsanalysen og udførselsfasen viser hvordan denne viden anvendes til at identificere en løsning, der kan bruges til at eliminere problemet.



Figur 5: Rod-årsagsproblemløsningsmetoden.

Problemløsningsmetodens store potentiale er dens effektivitet i at finde løsninger gennem en systematisk tilgang, som kan læres af de fleste i organisationer og dermed kan mobilisere mange i effektive forbedringsaktiviteter (læs fx Rother 2010).

Metoden er dog blevet kritiseret for at hæmme læring fordi den bygger på en afgrænset problemforståelse, der defineres i starten af processen (læs fx Barrett, 1995, og Avital, 2005), og også fordi metoden bygger på en logik drevet af normativ kausalitet, hvilket betyder at løsningerne baseres på allerede eksisterende mentale modeller og derfor lægger op til små trinvise forbedringer snarere end forbedringer af hele systemet (Benner & Tushman, 2003). Desuden har problemløsning en tendens til at fokusere på tekniske procesforbedringer og ikke nok på den nødvendige sociale

transformation og kapabilitetsopbygning af medarbejdere, ledere og teams (Liker & Convis, 2011).

Appreciative Inquiry-metoden

Appreciative inquiry er en alternativ forbedringsmetode der stammer fra David Cooperriders forskning, der viste at social forandring skete meget hurtigere og mere kreativt, når indsatsen fokuserede på at udvide eksisterende succeser end når det handlede om at eliminere problemer (Cooperrider, 1987). Dette fund anvendte han til at udviklede Appreciative Inquiry, en systematisk metode til at definere et ønskværdigt fremtidsstadie og til at opbygge kapabilitet til at opnå det baseret på fem principper (Cooperrider, Whitney & Stavros, 2011):

- *Forventningsprincippet*: Handlinger guides af billeder og forventninger om fremtiden, dvs. positive fremtidsforventninger skaber positive handlinger.
- *Konstruktionistprincippet*: Alle der skal være en del af en forandring bør deltage i konstruktionsprocessen for at kunne forstå den nye fremtid.
- *Det poetiske princip*: De emner, der får opmærksomhed vokser i folks hoveder og dermed er det nødvendigt for en forandringsproces at udvikle og fastholde et nyt sprog for det ønskede fremtidsstadie.
- *Det positive princip*: Opbygning af momentum til forandring kræver positiv affekt og sociale bånd såsom håb, begejstring, inspiration og et presserende formål.
- *Simultanitetsprincippet*: Forandring påbegyndes med det spørgsmål, der bliver stillet og analyse kan derfor ikke adskilles fra implementering.

Appreciative Inquiry har inspireret til flere nye ledelsestilgange, i Danmark blandt andet styrkebaseret ledelse (Brun & Ejsing, 2010) og anerkendende ledelse (Haslebo & Lyndgaard, 2007). Jeg har valgt at fastholde det amerikanske begreb i denne artikel, da jeg gerne vil fokusere på den oprindelige forbedringsmetode snarere end de ledelsesmæssige tilgange, der er blevet tilknyttet den danske oversættelse anerkendende udforskning. Appreciative inquiry som forbedringsmetode kan initieres hver gang der er en ønske om noget bedre, hvilket kan være både et problem eller en mulighed. Metoden kan opdeles i fem faser:

1) Definition af et attraktivt emne: Et fængslende og tiltrækkende spørgsmål for organisationen at besvare, hvor svaret initierer den ønskede forandring. Et attraktivt emne kan fx være det at omfortolke “vores problem er teamets lave produktivitet og høje fravær!“ til “hvordan bliver vi et højt performende team hvor alle anvender deres største styrker hver dag?“ Forskellen i engagement og handlemuligheder er

bemærkelsesværdig og viser simultanitetsprincippet i aktion: Alene dette spørgsmål vil påbegynde en forbedringsrejse.

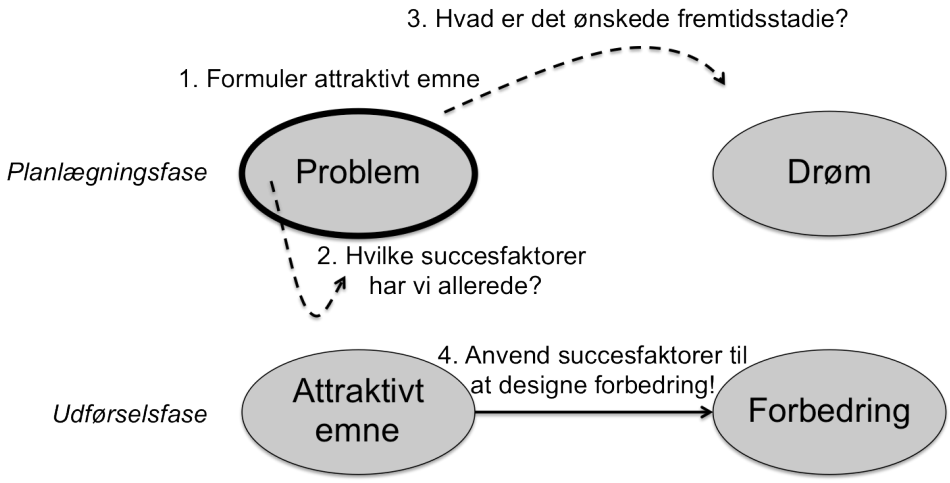
2) Succesfaktoranalyse af det, der allerede eksisterer i organisationen, der kan bidrage til at opnå det attraktive emne, fx positive erfaringer, styrker, viden, motivation, osv. Ved at dele historier, der fremhæver succeshistorier bliver de poetiske og positive principper sat i værk.

3) Skabelse af en delt fremtidsdrøm. I denne fase skal så mange deltagere som muligt engageres i at samskabe og visualisere et ønskværdigt fremtidsstadie. Dette aktiverer konstruktionistprincippet og forventningsprincippet.

4) Design af løsninger, der kan realisere det ønskede fremtidsstadie. Løsningerne skal gerne være provokerende på en sådan måde, at de får folk til at tænke og handle på nye måder. Succesfulde initiativer skaber ifølge et større forskningsprojekt af Bushe og Kassam (2005), at der bliver skabt en guidingende metaphor, der fortsætter hele vejen indtil implementering.

5) Implementering og virkeliggørelse af løsningerne.

Figur 6 illustrerer Appreciative Inquiry som forbedringsmetode. Først bliver problemet (eller muligheden) omfortolket til et attraktivt emne, dernæst bliver succesfaktorer identificeret og det ønskede fremtidsstadie visualiseret (drømmen). I udførselsfasen anvendes succesfaktorerne til at designe løsninger, der kan realisere forbedringen.



Figur 6: Rod-årsagsproblemløsningsmetoden.

Illustrationen viser hvordan Appreciative inquiry er fremtidsorienteret og skaber forbedring ved at bygge videre på systemets allerede eksisterende kapabiliteter. Denne metode antager, at det rent faktisk ikke er nødvendigt at kende problemet for

at kunne løse det, blot man kan forstå det ønskede fremtidsstadie. Appreciative Inquiry bringer på denne måde kapabilitetsopbygning ind i forbedringsmetoden: I det attraktive stadie ved at udvide løsningsrummet og generere nye sociale antagelser (læs fx Avital, 2005), i succesfaktoranalysen ved at accelerere læring gennem fokus på succesfulde erfaringer (læs fx Kirschenbaum et al., 1982, Barrett, 1995, og Rock & Schwartz, 2006) og endelig i visualiseringen af fremtidsstadiet ved at skabe et delt formål og positive fremtidsbilleder, der ifølge Cooperrider (2000) mobiliserer organisatorisk handlekraft og opbygger kapabilitet.

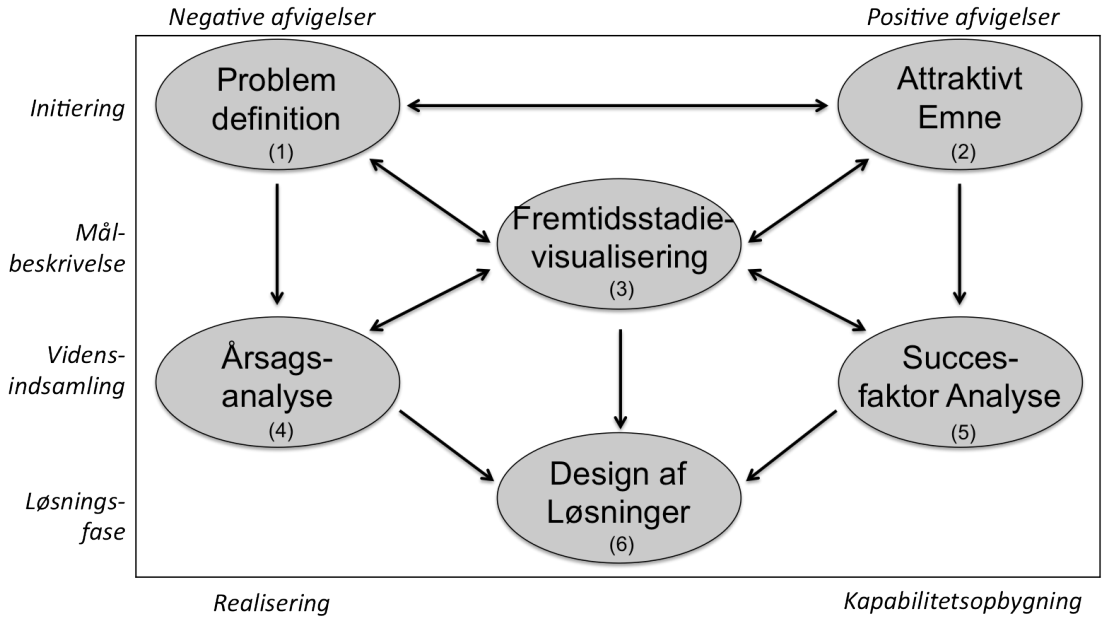
En bredere forståelse af forbedringsmetoder

Som illustrereret i de foregående afsnit, så er problemløsning og Appreciative Inquiry to ret forskellige metoder i form af hvordan de initierer forbedringer, beskriver målsætninger og indsamler viden: Problemløsning fokuserer på negative afvigelser mens Appreciative inquiry fokuserer på positive afvigelser.

De to metoders trin kan dog kombineres på andre måder end hver af metoderne umiddelbart lægger op til. Figur 7 viser en model, der fremhæver kombinationsmulighederne og dermed giver mulighed for at udvælge metoder, der bedre understøtter forbedringsstrategien end blot en af de to. De seks grå elementer repræsenterer de individuelle forbedringstrin og teksten til venstre viser hvilken kategorisering de tilhører. For eksempel, *initiering* af en forbedringsproces kan enten starte med en *Problem definition* (1) eller et *Attraktivt emne* (2). Pilene på modellen viser de forskellige kombinationsmuligheder og hver ny kombination vil repræsentere en ny forbedringsmetode.

Eksempelvis, så vil traditionelle problemløsning starte med Problem definition (1) efterfulgt af Årsagsanalyse (3) og slutte med Design af løsninger (6). Appreciative Inquiry vil starte med Attraktivt emne (2), dernæst Succesfaktor analyse (4), efterfulgt af Fremtidsstadie visualisering (3) og slutteligt Design af løsninger (6).

Selv om de to metoder umiddelbart virker inkongruente, så er de ikke gensidigt udelukkende. Flere velkendte forbedringsmetoder kombinerer allerede trin fra de to sider, fx Toyota Kata metoden (Rother, 2010), der anvender trin 1, 3, 4 og 6 og metoden Solutions Focus (Jackson & McKergow, 2007), der anvender trin 1, 2, 5 og 6.



Figur 7: Forbedringsmetodemodellen.

Tilføj nye metoder til din forbedringspallette

Forbedringsmetodemodellen kan bruges til at designe en specifik palette af forbedringsmetoder, der understøtter en specifik forbedringsstrategi. Trinene i venstre side af modellen betoner nemlig realiseringseffektivitet mens trinene i højre side betoner kapabilitetsopbygning. Hvis jeres organisation har indført problemløsning uden at balancere det med kapabilitetsopbyggende metoder kan modellen fx bruges til at indføre supplerende daglige forbedringsmetoder baseret på højre side. Test af modellen i flere virksomheder har eksempelvis dannet følgende tre metoder, men I kan måske bruge trinnene på helt andre måder.

- ***Lær af daglig succes:*** *Start med trin 2: "Hvordan kan vi løfte det bedste af det vi allerede gør?" Trin 5: Monitorer daglig performance og brug de situationer, hvor performance er over det forventede, som en anledning til systematisk succesfaktor analyse. Afslut med trin 6: Anvend læringen fra analysen til at finde løsninger, der kan sprede læringerne og forankre succeserne i fremtiden.*
- ***Sæt et fælles perspektiv på problemløsning:*** *Begynd med trin 1: Definer problemet og undersøg nutidstilstanden. Trin 3: Saml nøgleinteressenter og skab en fælles drøm omkring den ønskede fremtidsstadie, som I visualiserer. Trin 4: Analyser årsagen til problemerne. Trin 6: Design løsninger, der kan eliminere problemerne og realisere det ønskede fremtidsstadie.*

- ***Opløs problemer gennem kapabilitetsopbygning:*** *Initier trin 1: Definer problemet og undersøg nutidstilstanden. Trin 3. Saml nøgleinteressenter og skab en fælles drøm. Trin 5: Identificer succesfaktorer, der kan anvendes til at realisere drømmens elementer. Afslut med trin 6: Design løsninger, der kan få succesfaktorerne til at løse problemet.*

Konklusion

Kunsten at definere og udføre en forbedringsstrategi er efterhånden et afgørende konkurrenceparameter for de flere organisationer. Alligevel arbejder kun få eksplicit med denne opgave. Forbedringsindsatser skal simultant adressere de to dimensioner realiseringseffektivitet og kapabilitetsopbygning. Det eksplicitte valg omkring hvordan de to skal balanceres afhænger af en organisations kontekst og kan defineres som forbedringsstrategien. Denne artikel viser hvordan der kan skabes sammenhæng mellem forbedringsstrategi, forbedringssystemer og forbedringsmetoder. Det påpeges også hvordan forskellige metoder automatisk lægger forskellig vægt på de to dimensioner og at der derfor bør vælges metoder ud fra forbedringsstrategien. Den præsenterede forbedringsmetodemodel kan bruges som udgangspunkt til at diskutere hvilke metoder en organisation skal have på sin pallette for at for at understøtte sin strategi.

Om forfatteren

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MELLEMLEDELSE I FORBEDRINGSKULTUR
- Snubler jeres Lean-indsats i ledernes tre faldgruber?

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Lean er kommet for at blive. I over et årti har produktions- og serviceledelse i hele verden taget Toyotas produktionssystem til sig for at øge effektivitet og skabe løbende forbedringer. Japanske termer som kanban, muda og kaizen er ved at være mainstream sammen med forståelsen for floweffektivitet og visuel ledelse.

På trods af dusiner af gode Lean-bøger om værktøjer og metoder, masser af casebeskrivelser, samt dygtige Lean-specialister i virksomheder og konsulenthuse, står det centrale spørgsmål stadig tilbage: Hvordan skaber vi medarbejderdreven forbedringskultur? Der mangler ganske enkelt viden om hvordan man integrerer forbedring i arbejdet og hvordan man forankrer den kulturforandring, der skal til.

Denne artikel præsenterer et bud på, hvordan medarbejderdreven forbedringskultur kan gribes an, nemlig ved at sætte fokus på mellemledernes rolle, her bredt betragtet som afdelingsledere og førstelinje-ledere. De er nemlig i en position, hvor de kan være nøglen til at integrere drift og løbende udvikling. Men det kræver, at de formår at skifte fokus fra at løse daglige problemer til i stedet at opbygge og facilitere forbedringssystemer, hvor det er medarbejderne, der lykkes med at skabe løbende forbedring.

Med udgangspunkt i et forskningsprojekt på en Novo Nordisk fabrik illustreres hvordan mellemlederne kan sættes i stand til at være nøglen til succesfuld forbedringskultur.

Mellemlederens faldgruber i forhold til forbedringskultur

Tid er den største mangelvare for de fleste ledere. I mellemlederens travle arbejde med at levere, så er hylden med tid til forbedring næsten altid tom. Ledere på det operationelle plan har travle hverdage, og ofte er den ultimative fokus at udføre de opgaver, der holder driften kørende. Deres arbejdsopgaver er mange og spændvidden stor: Rapportering af data, afholdelse af tavlemøder, håndtering af driftsproblemer, udviklingssamtaler med medarbejdere, koordinere ad-hoc opgaver, håndtere kvalitetssager, osv., osv. Dette kan opsummeres til en velkendt faldgrube, der står i vejen for at mellemledere kan drive forbedringskultur: Tiden bruges på drift.

1. Faldgrube: Tiden bruges på drift

Mellemlederes tid udfyldes af driftsopgaver og ofte foregår forbedringsprojekter kun som ekstraordinære aktiviteter adskilt fra det daglige arbejde.

Det kan ikke undgås, at der en gang imellem opstår problemer, det er nødvendigt at løse inden for mellemledernes ansvarsområder. Når lederen selv hovedkuld kaster sig over problemløsningen, bliver det ofte til kortsigtede løsninger, som vi kalder brandslukning. Derfor er mere proaktiv problemløsning blevet en del af mellemlederens opgaver, men ofte er formålet og ansvaret ikke tydeligt afklaret.

I Lean terminologi anvendes begrebet 'Genchi Gembutsu', der betyder at gå ud og få syn for sagen hvor det sker, kontra det at arbejde distanceret med sagen. Dette ideal leder dog ofte mellemledere til at overengagere sig i forbedringer på det operationelle plan. For en handlekraftig mellemleder kommer hurtigt til at engagere sig i de konkrete opgaver, såsom at flytte maskiner eller lige at ændre på en procedure. Dette kan opsummeres til endnu en faldgrube: Mellemlederens problemløsningsfokus bliver for operationel. Derved glemmer de at udvikle rammerne for, at deres medarbejdere selv kan løse problemerne. Ledernes vigtigste opgave burde være at gøre det muligt for deres medarbejdere at performe, også når det drejer sig om forbedringer.

2. Faldgrube: Fokus bliver for operationel

Mellemlederne kommer til at fokusere på selv at levere de operationelle forbedringer og glemmer at udvikle rammerne for, at deres medarbejdere selv kan løse problemerne, altså det taktiske.

Når mellemlederne kommer til at fokusere på at løse de operationelle problemer selv, så giver det naturligt nok et yderligere pres på at optimere brugen af tiden. Når et problem opstår, kan det derfor friste at få det løst hurtigst muligt, snarere end at bruge det som anledning til dybere læring og bedre root-cause afklaring, så problemet ikke dukker op

igen. Enhver forretningsudfordring er en oplagt anledning til medarbejderudvikling, hvis medarbejderne får støtte og coaching undervejs. Men når tiden er knap kan dette glippe og vi får dermed en tredje faldgrube: Mellemlederne fokuserer på kortsigtede resultater frem for læring og medarbejderudvikling.

3. Faldgrube: Resultater frem for læring

Mellemledernes rolle ved forbedringer er ikke forstået og klart defineret. Derfor drejes fokus mod at løse operationelle problemer, fremfor at øge medarbejdernes forbedringskapabilitet gennem systemiske forbedringer.

Løsningen er et designet forbedringssystem

Så hvad er løsningen, når mellemlederens arbejde ofte er organiseret, så det leder til de tre faldgruber?

For at opnå succesfuld mellemledelse i en forbedringskultur må tre kriterier dermed gælde for løsningen: 1) Den skal skabe tid til forbedringsarbejde, så det ikke bliver opslugt af driften. 2) Den skal støtte mellemlederen i at skabe rammerne for forbedring, så det er medarbejderne der er udførende. 3) Den skal lægge op til langsigtet læring og medarbejderudvikling, ikke kortsigtet rationalisering.

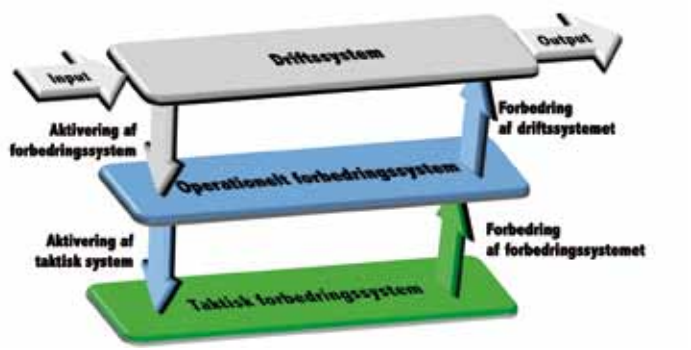
Vores bud på en løsning er at designe et forbedringssystem, der understøtter mellemlederne i at undgå faldgruberne og at få frirum til at udvikle deres medarbejderes forbedringsindsatser. Med et designet forbedringssystem mener vi et gennemtænkt koncept for, hvordan forbedringsarbejdet udføres, støttes og udvikles.

En Novo Nordisk afdeling har de seneste år arbejdet målrettet på at skabe rammer og rum for at støtte mellemlederne i at skabe forbedringskultur. Ved at organisere et taktisk forbedringssystem, som de deltager i med en fast frekvens, får mellemlederne anledninger til at minde hinanden om, hvordan de undgår faldgruberne og muligheder for at koordinere forbedringsindsatser på tværs af ansvarsområder.

Etablering af et taktisk forbedringssystem hos Novo Nordisk

Igennem en 3-årig periode har Novo Nordisk - Device Manufacturing and Sourcing (DMS) - arbejdet med at engagere mellemledere i forbedringsarbejde gennem et designet forbedringssystem. Det omtalte forbedringssystem er delt i to niveauer: Et operationelt forbedringssystem, der foregår på daglige tavlemøder, problemløsningsmøder og i problemløsningsaktiviteter, og et taktisk forbedringssystem, der har til formål løbende at udvikle rammerne for det operationelle forbedringssystem. Mens der er et stort udvalg af litteratur om det operationelle forbedringssystem, så mener vi at viden om, hvordan et taktisk forbedringssystem kan designes, er mangelfuld, og netop det taktiske forbedringssystem kan være nøglen til at aktivere mellemledere i at skabe forbedringskultur. Billede 1 viser hvordan de to systemer kan anskues i forhold til den daglige drift.

Novo Nordisk DMS Production har de seneste år arbejdet med at



Sammenhæng mellem driftssystem, operationelt- og taktisk forbedringssystem.

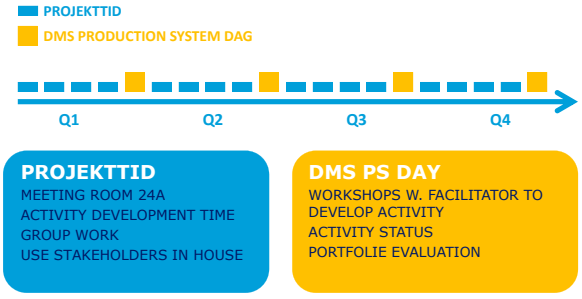
etablere et taktisk forbedringssystem, baseret på deltagelse af alle afdelingens ledere, ud fra følgende tre guidende principper:

1. Det taktiske forbedringssystem skal organiseres, så lederne kan få et frirum fra den daglige drift til at arbejde med forbedring
2. Lederne skal engageres i projekter, der forbedrer rammerne for medarbejdernes operationelle forbedringsarbejde
3. Lederne engageres ud fra deres individuelle styrker og lyst.

Dermed har DMS Production arbejdet målrettet på at skabe en fælles fokus blandt områdets ledere på at etablere medarbejderdrevet forbedringskultur, baseret på lyst frem for pligt.

Organisering af det taktiske niveau

Afdelingens ledergruppe får frirum til det taktiske forbedringssystem med jævne mellemrum. 4 gange om året samles alle lederne for at arbejde sammen en hel dag, kaldet DMS PS Day. På de dage afholdes workshops og deles viden, hvor ledernes opgave er at deltage aktivt i forbedringsprojekter. Derudover er to timer om ugen allokeret til at arbejde med projekterne, hvor interessenter kan være med eller uden en konsulent.



Projekttiden er de to ugentlige timer afsat til forbedringsprojekter, og DMS PS DAYs er fulde dage væk fra fabrikken, der bruges på workshops.

Inspiration til nye initiativer stammer dels fra ledernes egne behov, dels fra konsulenter og dels fra studieture og netværk. Men alle løsninger tilpasses DMS før de adopteres. Tilpasningen sker med udgangspunkt i princip nr. 2, og det kan kun lykkes succesfuldt, hvis medarbejderne er med til at designe forandringen.

To eksempler på taktiske forbedringsprojekter

Adskillelsen mellem det taktiske og operationelle forbedringssystem har gjort det muligt at undgå alle tre faldgruber. Det taktiske system sikrer nemlig fokus på at udvikle rammerne for at medarbejderne kan lykkes med forbedring i stedet for at lederne selv udfører alt arbejdet. Her er to eksempler på projekter foretaget på det taktiske forbedringsniveau.

MANAGER PARTNER UP

Dette projekt opstod på baggrund af hverdagens begrænsning, hvor det ikke var muligt for mellemledere at skabe tid til et afbalanceret arbejdsliv og samtidig overskud til at støtte medarbejderne i forbedringsarbejde. Lederne reflekterede derfor over, hvordan de kunne løse dette. Efter en workshop kom en løsning: Ved at finde en partner og at opdele ledelsesrollen mellem en operationel rolle (Front office) og en administrativ rolle (Back office) kunne de optimere overskud og støtte i forbedringsarbejdet. Før havde de begge skulle løfte alle opgaver hele tiden, hvilket betød, at de ikke kunne nå hvad de skulle. Løbende bliver de to rollers opgaver afstemt og holdt opdaterede på rollekort, som kan ses af billedet.

Ansvar for Back office rollen og Front office rollen. Dette er ikke en statisk eller generisk fordeling, men et udtryk for den situation, de to ledere stod i på det pågældende tidspunkt.

Denne løsning ledte både til større arbejdsglæde for lederne, mere effektiv ledelse på grund af færre daglige omstillinger og mere tilfredse medarbejdere, der fik bedre støtte og mere nærværende ledere. Medarbejdernes daglige problemløsning har fået bedre støtte efter at én leder er dedikeret til indsatsen i stedet for to, der ikke havde tid. Eksemplet her illustrerer hvordan det at designe et taktiske forbedringssystem kan sætte fokus på at øge forbedringskompetencen på arbejdspladsen – i modsætning til kun at løse operationelle problemer. Derved minimeres risikoen for den anden faldgrube. Det taktiske niveau blev i dette tilfælde støttet af en intern konsulent, der faciliterede processer og hjalp med håndtering af praktiske opgaver, men initiativet og løsningerne kom direkte fra de implicerede ledere.

OVERLEVERINGSTAVLE

I lang tid havde en gruppe teknikere fulgt den samme overleveringsproces og anvendt samme tavle, der stammede fra en tid hvor opgaverne var nogle andre. Under en DMS PS udviklingsdag gik det op for den ansvarlige leder, at opgavekompleksiteten var steget og at den eksisterende overleveringsproces og -tavle ikke gav særlig gode muligheder for løbende forbedring. Han gik derfor i gang med at forbedre overleveringsprocessen sammen med udvalgte medarbejde. Medarbejderne fik fremstillet nyt træningsmateriale og trænede alle kollegaerne til en ny rolle, hvor medarbejderne bliver mere aktive i overleveringsprocessen. Derved kunne lederen træde ud af de operationelle processer og få øget tid til at coache, facilitere forbedringsarbejde og at støtte medarbejderudviklingen.

Dette eksempel viser, hvordan et taktisk blik for forbedringsprocesserne kan øge fokus på læring hos medarbejderne og dermed minimere risikoen for den tredje faldgrube.

Hvad skal der til for at komme i gang?

De ovenstående projekter kunne kun finde sted, fordi afdelingslederen havde fokus på at udvise tillid og at støtte mellemlederne i selv at forme deres forbedringer. Hvis afdelingslederen var faldet i faldgruben om udelukkende at fokusere på operationelle forbedringer, så var det taktiske niveau ikke blevet skabt. Udfordringen er, at mellemledere på alle niveauer både skal have øje for drift og udvikling. Det kan kun effektueres ved at understøtte medarbejderes initiativ og kreativitet. En løsning er at skabe et innovativt rum baseret på jævnlige møder, og dermed skabe tid til refleksion og forbedringsarbejde. Dermed kan et taktisk niveau skabes. Ledergruppen hos DMS Production fik undervejs i deres udviklingsrejse to erkendelser:

- Gennemførelse af forbedringsaktiviteter er lige så vigtige som afvikling af drift, og det er nødvendigt at træffe beslutning på ledelsesniveau om at give plads til begge dele. Samtidig skal der ikke bare lægges flere opgaver på paletten, det skal ske ved at skabe et rum med tid og plads til kreativitet og innovation.

- Roller og ansvar i de forskellige organisatoriske lag skal defineres i forbindelse med forbedringsaktiviteter, og alle skal bidrage der, hvor deres indsats giver størst værdi. Det betyder, at mellemlederne skal forstå, at deres ansvar for forbedringer både foregår på et operationelt og et taktisk niveau, og at sidstnævnte handler om at muliggøre og understøtte, at medarbejderne skaber forbedringer.

Mere læsning

Toyotas tilgang til ledelse er beskrevet godt i Liker og Convis bog The Toyota Way to Lean Leadership fra 2011. Hvis du er nysgerrig efter endnu mere viden om ledelse af det operationelle forbedringssystem, så giver Rother's Toyota Kata fra 2010 praktisk indsigt. Den styrkebaserede tilgang til ledelse, som denne artikel har været meget inspireret af, er uddybet i Brun & Ejsings Styrkebaseret Ledelse fra 2010, som stærkt kan anbefales.

Jeffrey K. Liker & Gary Convis, The Toyota Way to Lean Leadership, MacGraw-Hill, 2011.
Pernille H. Brun & Mikkel Ejsing, Styrkebaseret Ledelse, Dansk Psykologisk Forlag, 2010.
Mike Rother, Toyota Kata – managing people for improvement, McGraw-Hill, 2010.

Diskussionsoplæg:

I hvilken grad kan I genkende de 3 faldgrupper der nævnes i artiklen? Del gerne Jeres erfaringer.
Deltag i debatten på www.effektivitet.dk under medlemsmagasin.

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Lean som fedtsugning eller STYRKETRÆNING

– Refleksioner om Lean som forbedringssystem

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Forbedringskapabilitet som strategisk disciplin

Det er nødvendigt at øge produktiviteten i Danmark. Der er pres fra stigende global konkurrence og færre hænder til at løfte fleres servicebehov i det offentlige. Derfor må alle former for organisationer øge produktiviteten ved at minimere ressourceforbrug og ved at øge værdiskabelse, fx gennem bedre produkter og services. Kort sagt er det 'at forbedre sig' blevet en strategisk disciplin, som både det private og det offentlige har brug for at mestre. Vi kan kalde denne organisatoriske evne forbedringskapabilitet, og måske er den endda det bedste bud på, hvad vi i Danmark skal leve af i fremtiden – vores evne til at skabe værdi og at minimere ressourceforbrug.

Forbedringskapabilitet som strategisk disciplin handler om at engagere alle i løbende forbedringer. Fx i at forbedre arbejdsgange, fjerne spild og bureaukratiske forhindringer, løse problemer, at få og implementere forbedringsidéer. Alt dette for at skabe mere værdi for kunden for færre ressourcer, så der kan konkurreres på fleksibilitet, innovationsevne og kvalitet frem for på omkostninger.

Lean er de seneste år blevet bredt anvendt som svar på, hvordan vi lykkes med produktivitetsudfordringen. Og det er med god grund, da denne japanske ledelsesfilosofi, udsprunget fra Toyota, har vist sig som et effektivt paradigmeskift i organisering og ledelse. Ved at organisere sig efter floweffektivitet og at bygge forbedringstænkning ind i alle organisatoriske lag kan Lean være en løftestang i alle brancher. Men det kræver en langsigtet og ihærdig indsats. I hvert fald hvis Lean skal bruges til at opbygge forbedringskapabilitet og ikke blot som kortsigtet rationalisering.

Fra fedtsugning til styrketræning

De første vestlige forsøg på at kopiere Lean fra Toyota ledte til hurtige gevinster gennem rationalisering. Især i bilindustrien, hvor mange tekniske løsninger kunne kopieres direkte, kan der tales om et revolutionerende nyt produktionssystem med eksotisk-lydende teknologier som Kanban, Andon og Heijunka. Idet løsningerne har umiddelbar effekt, blev de hurtigt kopieret til andre industrier, til administration og til udviklingsarbejde. I et årti har Lean været en vidt udbredt ledelsestrend, man næsten ikke har kunnet komme uden om i Danmark. Alle har skullet slanke organisationer og fjerne spild, og der har ikke manglet konsulenter til at hjælpe med analyser og løsninger.

Nuvel. Men over tid oplevede mange af organisationerne problemer, selv om de ellers mente, de var blevet ret Lean. Problemer, såsom at de umiddelbare gevinster begyndte at sande til

med faldende produktivitet, eller også stod organisationen overfor endnu et forbedringsbehov, men kunne ikke se hvordan de skulle komme videre, da de jo var blevet Lean. Denne Lean-tilgang kan næsten illustreres som en fedtsugning, der har god effekt på overfladen i en periode, men over tid falder kroppen tilbage til fortidens tilstand, da vanerne ikke har ændret sig.

Så hvad skete der? De seneste års forskning i Lean har vist, at der ligger meget mere under overfladen hos Toyota, som de første bølger af kopiering ikke gennemskuede. Succesfuld Lean handler nemlig ikke om fedtsugning og kortsigtede lappeløsninger, fx gennem konsulentdrevne rationaliseringer. Lean handler derimod om at etablere forbedringskultur, hvor alle organisatoriske lag løbende arbejder med forbedringer. Dette sker gennem langsigtet styrketræning af organisationen, hvor muskler opbygges i form af nye rutiner, systemer og tankesæt. Slankningen skal ske gennem styrketræning, ikke fedtsugning.

Forbedringsdilemmaet: Realisering eller kapabilitetsopbygning?

Så hvordan kan Lean-implementering gribes an som styrketræning? Det kan være fristende at kigge på Toyota og kopiere deres systematiske A3-forbedringsmetode, der handler om daglig problemløsning gennem performance monitorering, rod-årsags-analyse og fokus på at fjerne spild. Men dette kan lede til et ensidigt fokus. Problemeliminering kan få et andet centralt aspekt til at blive overset, nemlig det at styrke evnen til at forbedre. Denne opbygning kræver andre metoder, der fokuserer på at opbygge kultur fx ved at reflektere over succesoplevelser og ved at diskutere fremtidsstadier. Vi må derfor ikke glemme, at Toyota har haft 40 år til at opbygge forbedringskultur og modne forbedringssystemer, og at disse elementer også er centrale i Lean-implementering, på trods af at de er sværere at synliggøre.

Konklusionen er, at Lean implementering må balancere to vigtige dimensioner, som kan skabe et dilemma i den daglige forbedringspraksis: Skal der fokuseres på at løse problemer eller at opbygge kapabilitet? Dette spørgsmål kan mange mellemledere sikkert genfinde dagligt, fx når et problem dukker op, som de selv kan løse. Men hvis de selv løser det, vil medarbejderne ikke lære at kunne løse det i fremtiden. Så skal der satses på kortsigtet realisering eller langsigtet kapabilitetsopbygning?

Find jeres forbedringsstrategi

Dimensionerne kan illustreres tydeligere gennem en case: *"Sam var frustreret, idet maskinen havde været nede i dagevis grundet et trivielt problem. Endelig var defekten fundet, og maskinen oppe at køre igen. Men Sam var endnu ikke tilfreds. Han vidste, at det ville ske igen, og at organisationen ikke var i stand til at koordinere sine forbedringsindsatser godt nok. Han inviterede derfor nøgleinteressenter sammen til en række workshops, der endelig re-designede den daglige performancemødestruktur, og som ledte til ny træning af teamlederne. Resultatet: bedre koordination mellem enhederne, hurtigere problemløsning og bedre kvalitet og effektivitet."*

Først eliminerede Sam et performanceproblem, og dernæst styrkede han forbedringskapabiliteten. Det handler altså ikke om enten eller, men snarere om en bevidst strategi for at øge begge dimensioner:

1. Realiseringseffektivitet, der handler om, hvor stor en andel af det eksisterende potentiale og idéer, der bliver realiseret, fx ved at øge kvalitet, produktivitet, gennemløbstid, fjerne spild, osv.
2. Forbedringskapabilitet, der handler om organisationens evne til at skabe forbedringspotentiale, fx evnen til at få forbedringsidéer, koordinering, forbedringsmetoder, forståelse af strategiske mål, social kapital, osv.

En forbedringsstrategi består i at afveje indsatsen ift. de to dimensioner og bør baseres på, hvad der skal til at flytte organisationen op mod højre hjørne, se figur 1.

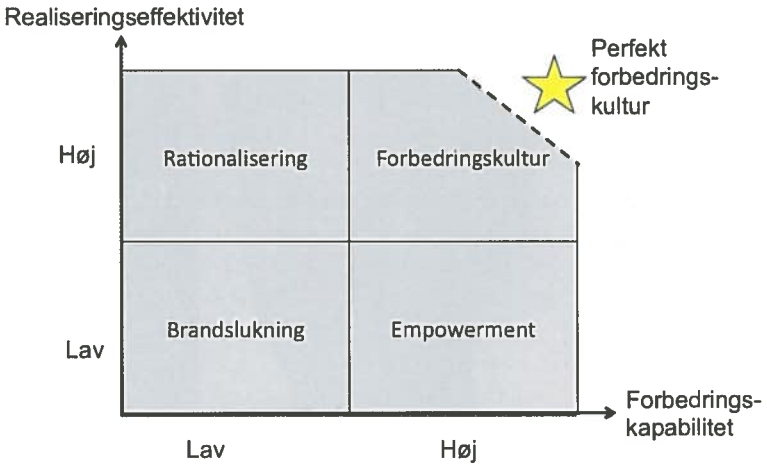

Fig. 1 Forbedringsstrategier baseret på afvejning mellem realiseringseffektivitet og forbedringskapabilitet.

Den usynlige dimension af Lean: Forbedringssystemet

Lean handler altså ikke kun om at skabe et effektivt arbejdssystem med flow uden spild. Lean handler altså også om at lære at forbedre løbende. Denne forbedringskapabilitet er af forskerne Zollo & Winter (i tidsskriftet Organization Science, 2002) uddybet som "et tillært og stabilt mønster af kollektiv aktivitet, gennem hvilken organisationen systematisk genererer og modificerer operationelle rutiner i jagten på øget effektivitet."

Denne definition tydeliggør en usynlig, men afgørende dimension af Lean, nemlig et stærkt underliggende forbedringssystem. Lean kan altså anskues med to niveauer: Øverst et arbejdssystem med flow og kendte metoder, fx Kanban og standardiseret arbejde. Herunder et helstøbt forbedringssystem, der med systematiske processer løbende forbedrer det øverste system. Hemmeligheden ved Lean-implementering er derfor at opbygge begge

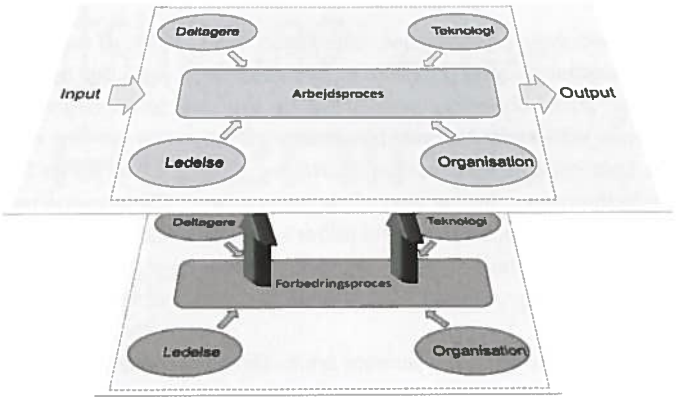

Fig 2. Lean i to niveauer: Som Arbejdssystem og som forbedringssystem.

niveauer og ikke kun det øverste. Se figur 2 for illustration. Nøglen til forbedringskultur er at skabe sammenhæng mellem lagene, så det nederste både skaber forretningsforbedringer og udvikling af deltagerne.

Denne artikel har vist, hvordan Lean ikke kun handler om effektiv drift, men lige så meget om at etablere et forbedringssystem til løbende udvikling af arbejdssystemet. Nøglen til succes er ledelse, der skal skabe sammenhæng mellem de to lag. Denne Lean-tilgang kræver derfor anderledes ledelse end performance management og new public management lægger op til. Ledernes nye opgave er at skabe rammerne for daglig forbedring af arbejdsprocesser og medarbejderkompetencer. Det kræver deltagelse i samtaler omkring det egentlige værdiskabende arbejde snarere end at sidde på et kontor og måle performance og udstikke opgaver.

For mere inspiration:
Jeffrey K. Liker & Gary Convis (2011). The Toyota Way to Lean Leadership. McGraw-Hill. Mike Rother (2010). The Toyota Kata. McGraw-Hill.

OM fortatteren

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er ledelseskonsulent hos Resonans A/S og ErhvervsPhD-kandidat på DTU Management Engineering på Danmark Tekniske Universitet (DTU). Han er uddannet civilingeniør i kemi og bioteknologi fra DTU og har været gæsteforsker på University of Michigan samt været på studieophold på University of Wisconsin–Madison og Case Western Reserve University. Har forelæst i USA og Nordeuropa.

"Dårlig kultur æder lean-værktøjer til morgenmad!"

19. september 2013 - Af David Wedege

Det er helt afgørende for succesfuld lean-implementering at få alle medarbejdere, også ufaglærte, engageret i at sige deres mening og skabe forbedringer, lyder det i aktuelt forskningsprojekt.

- Hvis du ikke lykkes med en kulturforandring, så kan du indføre nok så gode værktøjer, men de kommer ikke til at virke, siger lean-forsker for DTU og Resonans, David Hansen.

- Tænk hvis alle medarbejdere gjorde, hvad jeg sagde, det ville være det værste, der kunne ske, siger erhvervsforsker David Hansen fra konsulentvirksomheden Resonans.

Selv om han elsker citatet og synes, at de siger en masse om god lean-tænkning, så er ordene ikke hans egne. De tilhører derimod en chef i en af de mange virksomheder, som han har talt med under sin forskning.

I samarbejde med Danmarks Tekniske Universitet er David Hansen og Resonans ved at færdiggøre et treårigt forskningsprojekt om implementering af lean i danske virksomheder, som ventes at være færdig omkring nytår.

Forbedringskultur, ikke værktøjskultur
En helt central opdagelse i forskningen har været, at lean kræver væsentlige kulturforandringer i virksomheden, hvor medarbejderne engagerer sig med deres initiativ og kreativitet. Dette er der sådan set ikke noget nyt i, mener David Hansen.

Den nye opdagelse er ifølge David Hansen, at en fokuseret indsats omkring en lean-kultur er en mere effektfuld start på et lean-projekt end at begynde med værktøjerne.

- Dårlig kultur æder simpelthen lean-værktøjer til morgenmad!, siger han.

- Hvis du ikke lykkes med en kulturforandring, så kan du indføre nok så gode værktøjer, men de kommer ikke til at virke. Lean handler om at skabe en forbedringskultur, hvor alle stræber efter at

blive bedre og tager ansvar.

Pluk ikke bare de nemme frugter
En undersøgelse har vist, at mere end halvdelen af alle virksomheder, som har forsøgt sig med lean er utilfredse med implementeringen. David Hansen noterer sig blandt andet, at mange griber lean an som en ren spareøvelse:

- På den måde kommer man nemt til at begrænse medarbejdernes handlerum, hvor man i stedet for skulle udvide deres handlerum. Det kræver, at man får etableret en positive overskudsfølelse. Rationaliseringer kan aldrig stå alene, når vi taler om lean. Der må en nuanceret forbedringsstrategi til, der balancerer kortsigtet gevinst med langsigtet opbygning af kapabiliteter.

I det hele taget anbefaler han på baggrund af forskningen, at man starter med at ændre kulturen og først senere indfører værktøjer for at understøtte den forandring, der er i gang. Medarbejderne skal lære at kigge ud over deres egen produktionscelle, at samarbejde på tværs og at tage initiativ til at finde forbedringer.

- Alt for mange, som vi har lavede kvalitative interview hos, har startet med værktøjerne og tænkt, at så kom kulturen af sig selv. Men det skete bare aldrig for dem. Jeg foreslår, at man starter med kulturen og indstiller sig på, at det bliver en årelang proces. Lean er en udviklingsrejse, der aldrig slutter.

Metal Supply sætter fokus på lean
Metal Supply vil i de kommende uger have særlig fokus på lean med en række af artikler, som alle behandler emnet.
Redaktionen hører gerne fra folk, der har gjort sig gode såvel som dårlige erfaringer med lean på virksomhedsplan. Send din historie med kontaktinformationer på denne mail.

Artiklen er en del af vores tema om **null**.

The Productivity Code describes the challenge of achieving sustainable organizational performance in a rapidly changing world. Although the challenge has been addressed for decades, practitioners and researchers still struggle, and no coherent advice or theories have been established.

This PhD thesis provides new practical and theoretical insights to decode the productivity code by integrating Lean, the strength-based perspective, and organizations theory. These insights are combined towards an improvement theory for sustainable organizational performance.

The research was an industrial PhD collaboration between DTU, Resonans A/S, and Novo Nordisk A/S formed as a 3-year action research study at a medium-sized manufacturing facility.

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